



# INSTALLATION AND SERVICE MANUAL



Model: HSE-125-N/P, HSE-145-N/P  
Gas-fired Condensing Boiler and  
Instantaneous Water Heater



## **WARNING**

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS**
  - Do not try to light any appliance.
  - Do not touch any electrical switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.
- Improper, installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Read all instructions before installation or service.
- Save this manual for future reference.

### **Allied Engineering Company**

Division of E-Z-Rect Manufacturing Ltd.

Manufacturers of Gas and Electric Boilers, Stainless Steel Tanks, Heat Exchangers and Electric Boosters.  
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### ABOUT OUR MANUALS

Your *Super Hot Intergas* appliance has been provided with two manuals:

- *User's Information Manual* - This manual is intended for the **owner or user** of the appliance and provides information on routine operation and maintenance, and emergency shutdown.
- *Installation and Service Manual* - This manual must only be used by a **qualified heating installer, service technician or gas supplier**. Installation or service by anyone unqualified to do so may result in severe personal injury, death or substantial property damage.

Both manuals should be kept in the envelope provided and affixed adjacent to the appliance so that they are readily available for future reference.

### ABBREVIATIONS AND NAMES USED

Description	Referred to as
HSE condensing boiler and water heater	Appliance
Central heating	CH
Domestic hot water	DHW (also HW)
Appliance with piping for central heating (boiler)	CH system
Appliance with piping for domestic hot water heating	DHW system

### ICONS

The following symbols may be used in this manual:



#### DANGER

DANGER indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.



#### WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



#### CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

#### CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in property damage.

#### NOTICE

Special instructions which are important but not related to personal injury or property damage.

### TECHNICAL SUPPORT

For information about specific adjustments, installation, maintenance and repair activities, please contact Allied Engineering Company.

## TECHNICAL SPECIFICATIONS

Technical data	HSE-125-N	HSE-125-P
	Natural Gas	Propane

CH (central heating – BOILER)		
Nominal input rate*	1000 Btu/h (kW)	28.7 – 124 (8.4 – 36.3)
Nominal output rate	1000 Btu/h (kW)	27.3 – 118 (8.0 – 34.5)
AFUE	%	95
Maximum CH operating pressure	psi (bar)	43 (3.0)
Maximum CH operating temperature	°F (°C)	194 (90)

DHW (domestic hot water – HEATER)		
Nominal input rate*	1000 Btu/h (kW)	28.7–124 (8.4 – 36.3)
Nominal output rate	1000 Btu/h (kW)	25.3 – 109 (7.4 – 31.9)
Energy Factor (EF)**		0.88   0.91
DHW minimum flow rate	USGPM (l/min)	0.53 (2.0)
DHW continuous delivery at 135°F (with 77 °F water temperature rise)	USGPM (l/min)	2.8 (10.7)
DHW continuous delivery at 120 °F ( with 60 °F water temperature rise)	USGPM (l/min)	3.6 (13.7)
Maximum DHW temperature	°F (°C)	150 (65)

Electrical data		
Mains voltage / frequency	Vac / Hz	120 / 60
Consumed power: full load	W	110
Consumed power: standby	W	10

Overall dimensions and weight		
Height	inch (mm)	31.9 (810)
Width	inch (mm)	17.7 (450)
Depth	inch (mm)	10.6 (270)
Weight	lbs (kg)	86 (39)

Connections		
CH supply	inch NPT male	¾
CH return	inch NPT male	¾
DHW supply	inch NPT male	½
Cold water for DWH	inch NPT male	½
Gas	inch NPT male	½
Condensate drain flexible pipe, outside diameter	inch (mm)	1 (25)
Air supply inlet (without adapter installed)	mm	80
Flue gas outlet (without adapter installed)	mm	80
Air supply inlet with adapter installed	inch	3
Flue gas outlet with adapter installed	inch	3

\* The CH & DHW input rate is set to 100 % by default (see *Setting CH & DHW input rating*).

\*\* The energy factor (EF) is the ratio of energy delivered to the water as compared to the total energy consumed.

Note: NPT = National Pipe Thread

## TECHNICAL SPECIFICATIONS

Technical data	HSE-145-N	HSE-145-P
	Natural Gas	Propane

CH (central heating – BOILER)		
Nominal input rate*	1000 Btu/h (kW)	33 – 145 (9.7 – 42.5)
Nominal output rate	1000 Btu/h (kW)	31 – 136 (9.1 – 39.9)
AFUE	%	94
Maximum CH operating pressure	psi (bar)	43 (3.0)
Maximum CH operating temperature	°F (°C)	194 (90)

DHW (domestic hot water – HEATER)		
Nominal input rate*	1000 Btu/h (kW)	33 – 145 (9.7 – 42.5)***
Nominal output rate	1000 Btu/h (kW)	29 – 128 (8.5 – 37.4)
Energy Factor (EF)**		0.88   0.91
DHW minimum flow rate	USGPM (l/min)	0.53 (2.0)
DHW continuous delivery at 135°F (with 77 °F water temperature rise)	USGPM (l/min)	2.8 (10.7)
DHW continuous delivery at 120 °F ( with 60 °F water temperature rise)	USGPM (l/min)	3.6 (13.7)
Maximum DHW temperature	°F (°C)	150 (65)

Electrical data		
Mains voltage / frequency	Vac / Hz	120 / 60
Consumed power: full load	W	150
Consumed power: standby	W	10

Overall dimensions and weight		
Height	inch (mm)	31.9 (810)
Width	inch (mm)	17.7 (450)
Depth	inch (mm)	10.6 (270)
Weight	lbs (kg)	86 (39)

Connections		
CH supply	inch NPT male	¾
CH return	inch NPT male	¾
DHW supply	inch NPT male	½
Cold water for DWH	inch NPT male	½
Gas	inch NPT male	½
Condensate drain flexible pipe, outside diameter	inch (mm)	1 (25)
Air supply inlet (without adapter installed)	mm	80
Flue gas outlet (without adapter installed)	mm	80
Air supply inlet with adapter installed	inch	3
Flue gas outlet with adapter installed	inch	3

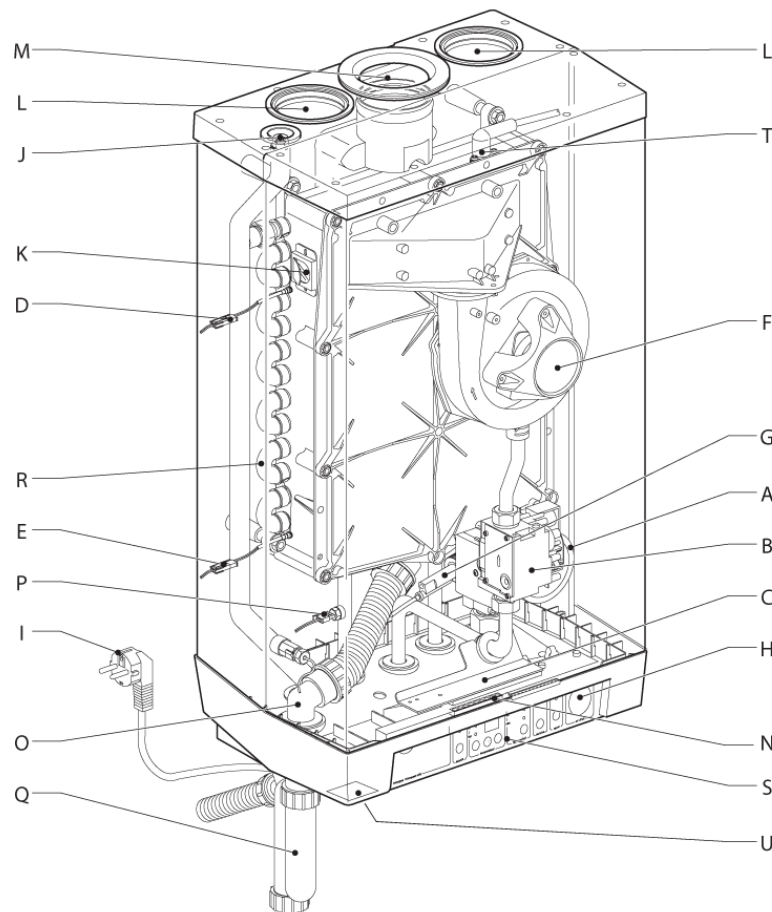
\* The CH input rate is set to 100% & DHW to 85% by default (see *Setting CH & DHW input rating*).

\*\* The energy factor (EF) is the ratio of energy delivered to the water as compared to the total energy consumed.

\*\*\* The DHW Booster function operates at an input rate of 145,000 Btu/h (42.5 kW) for the first 2min after which the DHW input rate drops to 124,000 Btu/h (36.3 kW)

Note: NPT = National Pipe Thread

## MAJOR COMPONENTS



- |   |   |   |                                    |
|---|---|---|------------------------------------|
| A | CH pump                                   | M | Flue discharge                     |
| B | Gas valve                                 | N | Wiring connecting block / terminal |
| C | Burner controller with operating panel    | O | Condensate discharge               |
| D | Supply sensor S1                          | P | DHW sensor S3                      |
| E | Return sensor S2                          | Q | Condensate trap                    |
| F | Blower                                    | R | Heat exchanger                     |
| G | DHW Flow switch                           | S | Operating and display panel        |
| H | CH Pressure gauge                         | T | Ionisation/ignition probe          |
| I | N/A                                       | U | Front cover fixing screw           |
| J | CH manual air vent                        | V | High limit S7 (not shown)          |
| K | Sight glass and mirror for checking flame | W | Flue sensor S8 (not shown)         |
| L | Air supply                                |   |                                    |

### Additional Components (supplied with appliance)

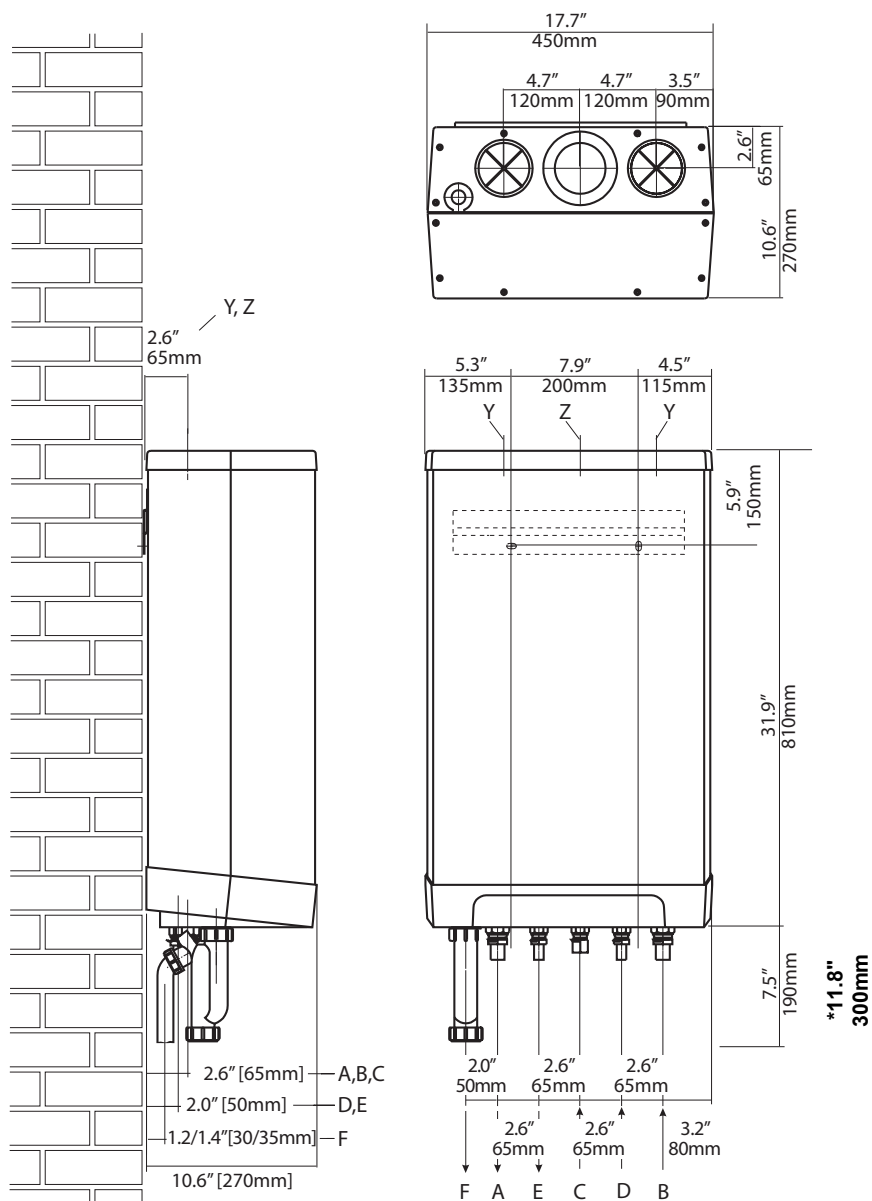
- |   |                                   |   |                               |
|---|-----------------------------------|---|-------------------------------|
| 1 | Compression fittings for CH pipes | 4 | Wall mounting strip           |
| 2 | Vent adapters - 80mm to 3" CPVC   | 5 | Pressure relief valve, 30 psi |
| 3 | Outdoor sensor                    | 6 | Drain valve                   |

### Optional Accessories (ordered separately)

- |   |  |   |  |
|---|--|---|--|
| 1 | DHW kit - includes compression fittings for DHW pipes, 125 psi PRV, etc. | 3 | Propane conversion kit                   |
| 2 | Condensate Neutralization Kit  | 4 | Mounting frame                           |
|   |  | 5 | Computer interface cable for diagnostics |



## DIMENSIONS



A=	CH supply	22mm diameter pipe (fitting is 22mm to 3/4" NPT male)	*	HSE-145	
B=	CH return	22mm diameter pipe (fitting is 22mm to 3/4" NPT male)			
C=	Gas	1/2" NPT male			
D=	Cold water for DHW	15 mm diameter pipe (fitting is 15mm to 1/2" NPT male)			
E=	DHW	15 mm diameter pipe (fitting is 15mm to 1/2" NPT male)	Y=	Air supply inlet	80 mm diameter (with vent adapter: 3")
F=	Condensate	1" (25mm) diameter flexible tube	Z=	Flue gas outlet	80 mm diameter (with vent adapter: 3")

### DESCRIPTION OF THE APPLIANCE

The Super Hot Intergas HSE is a combined high efficiency condensing boiler and instantaneous water heater that is designed for providing Central Heating (CH) and/or Domestic Hot Water (DHW). The actual required input rate for CH and DHW can be independently programmed lower than the maximum input rate to match the user's design heating load and required DHW supply. During operation, the input rate will be automatically modulated to satisfy the central heating or domestic hot water demand.

The heat exchanger is constructed of two separated copper tube circuits (i.e. CH and DHW) embedded in high-pressure cast aluminium. This design protects against corrosion by using copper tube to contain system water and aluminium to condense flue gases. The DHW system eliminates typical standby heat losses as compared to hot water tanks, isolates the domestic hot water from potential contamination as compared to a single wall indirect tank or flat plate heat exchanger, and has a higher efficiency as compared to a direct-fired hot water tank.

Because of the separated circuits for CH and DHW, the heating and the hot water supply operate independently of each other. The hot water supply has priority over the central heating if both systems are connected; they cannot work simultaneously. It is possible to use the appliance solely for hot water or solely for heating with the unused system not connected. Also, the DHW circuit can be connected to a storage hot water tank, but cannot be connected to a closed system (e.g. the coil of an indirect hot water tank).

The appliance is equipped with an electronic controller to energize the pump, control the blower, open the gas valve, ignite the burner, continuously monitor the flame and modulate the input rate to match the current heat demand.

The appliance is certified as a direct vent (balanced flue) only. The combustion air supply and flue discharge can be connected to the appliance by means of two separate pipes or a concentric connection.

The appliance must be wall mounted and can be mounted using either the supplied wall mounting strip or the optional wall mounting frame. The frame provides the spacing needed for a large elbow when venting through the sidewall on which it is mounted. Also, the frame can hold a square expansion tank and allows piping to pass behind the appliance for a very compact installation. The wall mounting frame and expansion tank are supplied separately.

The appliance is factory equipped for natural gas. An optional propane conversion kit, included with conversion instructions, can be supplied upon request.

The appliance includes standard parts for connection to a central heating (CH) system. For connection to domestic hot water heating (DHW) system, the DHW kit must be used with the appliance and can be supplied upon request.

Using the appliance for any other application which is outside of the scope is not covered by the warranty.

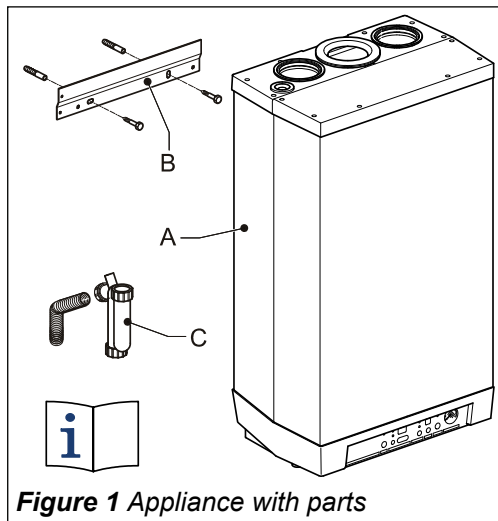
## Installation Instructions

## Section 1

**1.1 RECEIVING, MOVING AND UNPACKING**

**INSPECT SHIPMENT FOR POSSIBLE DAMAGE.** All goods are carefully manufactured, inspected, checked and packed by experienced workers. The manufacturer's responsibility ceases upon delivery of goods to the carrier in good condition. Any claims for damage and/or shortage in shipment or non-delivery must be filed immediately against the carrier by the consignee. Use care when receiving, moving and unpacking the appliance. Dropping the appliance may cause damage and prevent safe and proper operation. Only transport the appliance using the right transportation equipment, such as a hand truck with a fastening belt or special equipment for maneuvering steps. During transportation, observing the transportation markings on the packaging and securing the appliance on the transportation equipment to prevent it from falling off.

Unpacking the appliance and check the parts packaged in the carton with the appliance. The appliance, mounting strip, condensate trap, installation instructions and warranty card are included in the carton. Refer to Figure 1.



**Figure 1** Appliance with parts

**1.2 INSTALLATION CODES AND REQUIREMENTS**

All applicable national, provincial/state, and local codes, laws, regulations, and ordinances must be followed. They expand on and take precedence over any recommendations in this booklet. Authorities having jurisdiction shall be consulted before installations are made.

In **Canada**, the installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the *Natural Gas and Propane Installation Code* (current edition), *CAN/CSA B149.1*. All electrical wiring and grounding must be in accordance with the *Canadian Electrical Code, CSA C22.1 Part 1* (current edition) and applicable local codes.

In the **United States of America**, the installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* (current edition). All electrical wiring and grounding must be in accordance with the *National Electrical Code, ANSI/NFPA 70* (current edition) and applicable local codes.

Where required by the authority having jurisdiction, follow the *Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1* (current edition).

If there is any conflict in the above requirements, the more stringent requirement applies.

The installation and service must also conform to the additional requirements in this manual. If there is any conflict with a requirement in this manual and a Code requirement, the Code requirement must be followed.

The hot water distribution system must comply with all applicable codes and regulations. When replacing an existing appliance, it is important to check the condition of the entire hot water distribution system to ensure safe operation.

Some jurisdictions may require that flue condensate be neutralized prior to disposal because flue condensate is very corrosive and will corrode most metals.

## 1.3 LOCATION AND INSTALLATION

### 1.3.1 LOCATION

This appliance is intended for an indoor, wall hung installation using the wall mounting strip or optional mounting frame. The appliance should be mounted on a wall with sufficient bearing strength. In the case of light wall constructions, resonance sounds may occur.

In order to avoid freezing of the condensate discharge, the appliance should be installed in a frost-free room.

A hot water boiler installed above radiation level, or as required by the authorities having jurisdiction, must be provided with a low water cutoff device at the time of boiler installation.

This appliance must be installed such that gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, condensate trap, control replacement, etc.).

Structure through which venting will pass must be free and clear for opening (i.e. no hidden conduit, telephone cables or other obstructions).

### 1.3.2 MINIMUM SERVICE CLEARANCES

Minimum clearances from appliance casing to combustible materials are zero however reasonable space must be provided for ventilation. Recommended minimum clearances for service are listed in table 1.

**Table 1** Recommended Minimum Service Clearances

Recommended Minimum Service Clearances											
Left/right side without piping		Left/right side with piping		Rear		Front		Top		Bottom	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1	25	24	700	0	0	28	700	7	178	10	254
- Flue Vent Clearance = 1 inch (25 mm) - Hot Water Pipe Clearance = 1 inch (25 mm)											

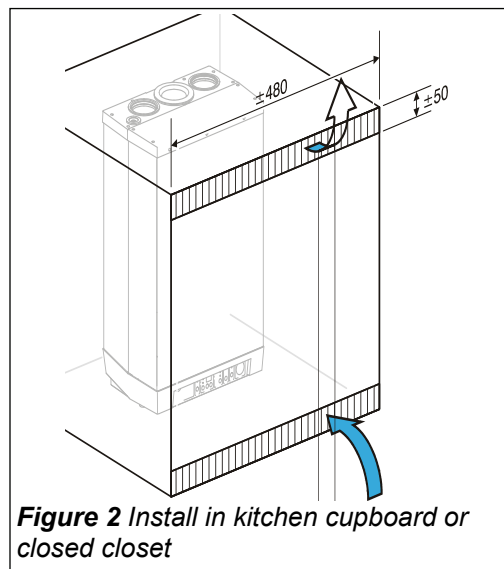
### 1.3.3 INSTALLATION IN A KITCHEN CUPBOARD OR CLOSET

Make sure there is sufficient ventilation above and below the appliance.

When the appliance is placed in a small cupboard, ventilation openings of at least 8 in<sup>2</sup> (50 cm<sup>2</sup>) must be made. Refer to Figure 2.

### 1.3.4 INSTALLATION IN AN AIRING CUPBOARD OR CLOSET

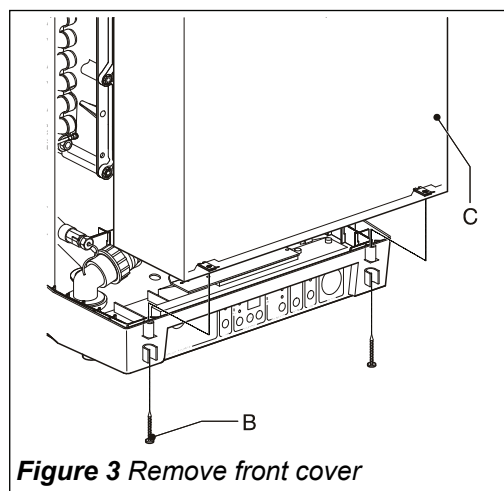
Compartment ventilation is not required for a standard airing cupboard or closet (e.g. 24 x 24 x 91in high or 0.6 x 0.6 x 2.3m high).



### 1.3.5 REMOVE FRONT COVER

Remove the front cover on the appliance as follows, refer to Figure 3:

1. Unscrew both screws (B) at the bottom of the appliance.
2. Lift the front panel (C) and remove it forward.



**Figure 3** Remove front cover

### 1.3.6 MOUNTING

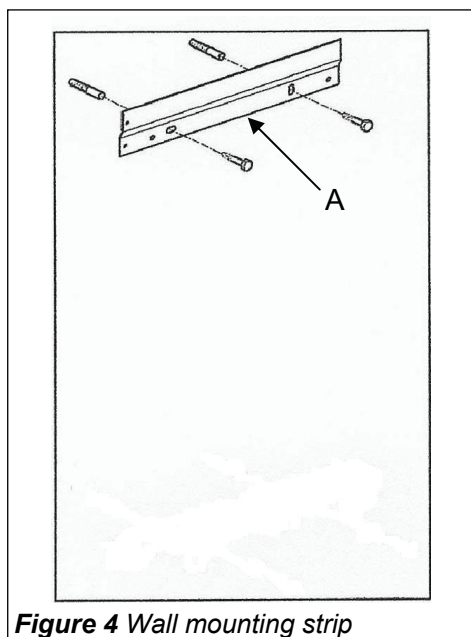
There are two types of mounting methods. Wall mounting strip (A) is the standard appliance mounting bracket and wall mounting frame (B) is an optional mounting frame which holds a square expansion tank. For mounting the appliance on the inside of an external wall through which sidewall venting passes, wall mounting frame (B) is recommended to provide sufficient clearance for venting elbows.

Option One – Wall mounting strip (A) Only (Refer to Figure 4)

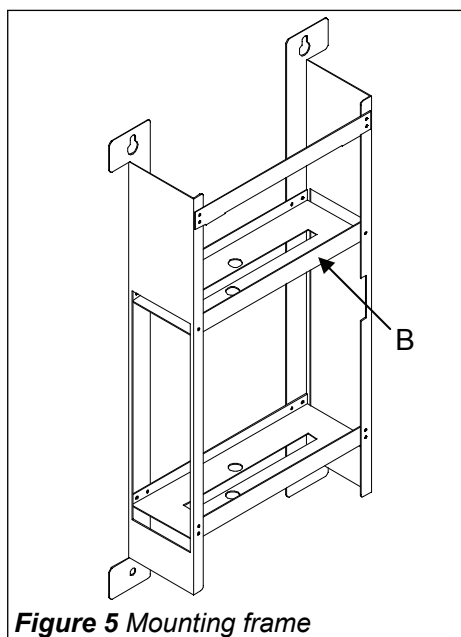
1. Use the screws and plugs supplied to fasten the bracket horizontally to the wall.
2. Hang the appliance by sliding it top-down over the standard mounting strip.
3. Install the parts of the various connecting sets.

Option Two – Mounting frame (B) (Refer to Figure 5)

1. Use the screws and plugs supplied to fasten the mounting frame (B) vertically to the wall.
2. Connect the expansion tank to the heating system before connecting appliance piping.
3. Hang the appliance by sliding it top-down over the mounting frame.
4. Install the parts of the various connecting sets.



**Figure 4** Wall mounting strip



**Figure 5** Mounting frame

### 1.3.7 INSTALL THE CONDENSATE TRAP (Refer to Figure 6)



#### WARNING

Risk of exhaust gases escaping to the appliance room! The condensate trap must always be filled with water or condensate so that it forms a liquid-filled trap. Check the trap and, if low, fill it until water begins to pour out of the drain.

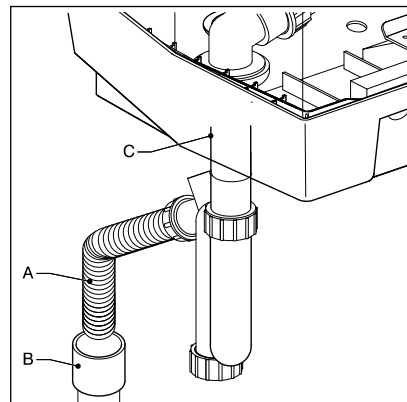
Install the condensate trap to the condensate outlet pipe (C) and tighten union.

The flexible tube (A) from the condensate trap should be inserted into an open waste pipe (B) of not less than 1-1/4 inch (32 mm) diameter or a neutralization unit. If connected to a soil pipe or waste system, the waste pipe must have a trap (similar to the arrangement for washing machine).

The condensate formed both in the appliance and the venting system is collected in the collector at the bottom of heat exchanger and is discharged into the public sewage system through the condensate trap. The condensate produced by the gas combustion products typically has a pH value between 3 and 4. Some local codes may require that the aggressive and corrosive condensate be neutralized before discharging it into the public sewage system. If a neutralization unit is installed, all condensate passes through the neutralization unit and is neutralized to a pH value of above 6.5 before release to the public sewage system. It is advisable to contact your local authority responsible for waste water regulations before commencing with the installation of the neutralization unit.

The amount of neutralizer needed will depend on the operation of the appliance. To determine the required refill amount, check granulate level several times throughout the year, or as necessary. In some cases one granulate fill may last an entire year. Contact Allied Engineering Company for a condensate neutralization kit when required.

Never use copper or steel/galvanized pipe in the construction of the condensate system. Route condensate drain line in a manner such that any condensate leakage will not cause property damage. Do not run flue condensate line outside. A frozen or blocked drain will cause the condensate to fill the combustion chamber and cause the boiler shut down. When a condensate pump is used or required, select a pump that is designed for pumping the condensate of condensing residential furnaces (i.e. corrosion resistant).



**Figure 6** Install condensate trap

## 1.4 WATER PIPING SYSTEMS

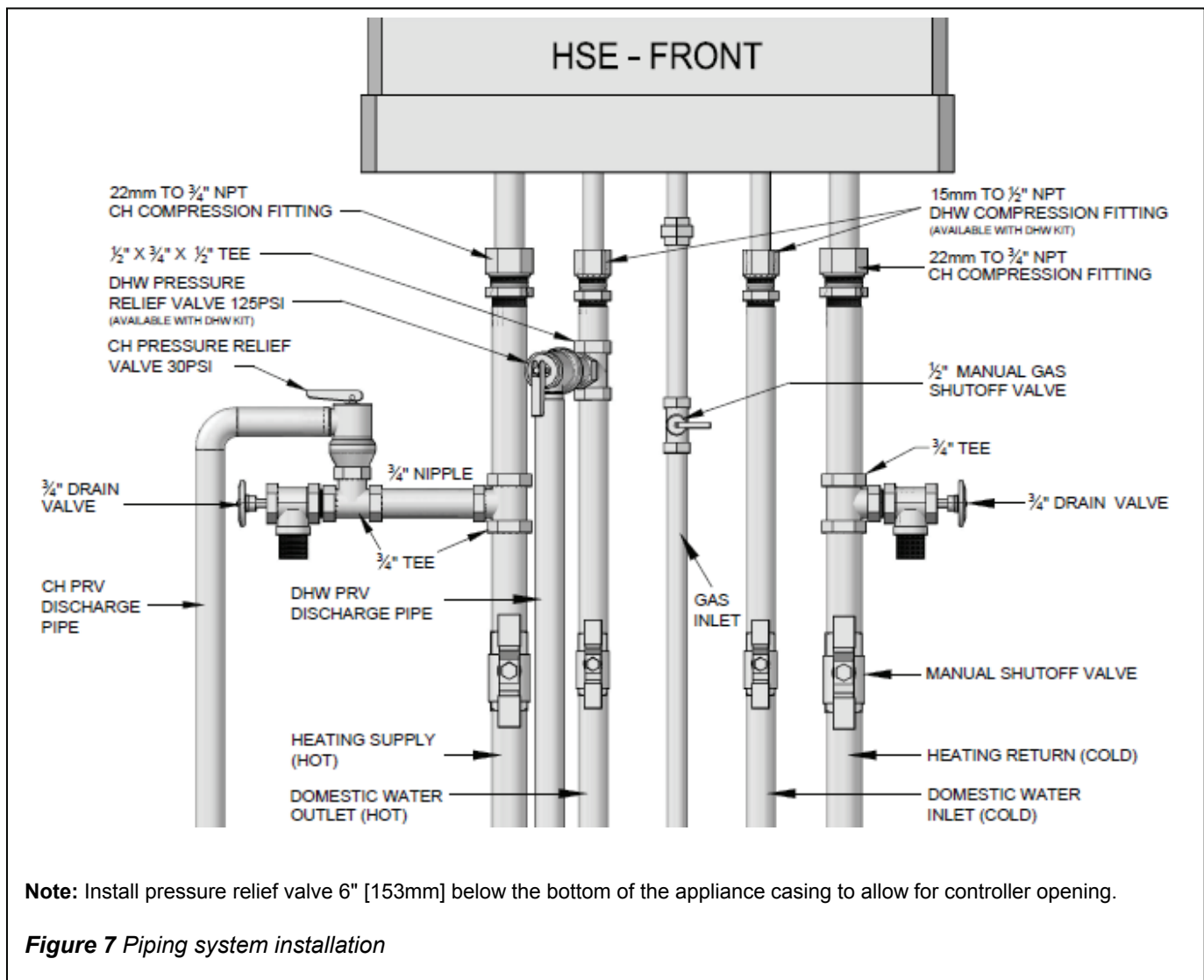
The water piping system of an appliance connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

The appliance, when used in connection with a refrigeration system, must be installed so the chilled medium is piped in parallel with the appliance with appropriate valves to prevent the chilled medium from entering the appliance.

### 1.4.1 CH PIPING SYSTEM (BOILER)

#### 1.4.1.1 CH PIPING CONNECTIONS (Refer to Figure 7)

1. Use the compression fittings supplied with the appliance to connect the heating system supply and return pipes. Check whether the compression rings are straight in the connectors. All pipes must be installed tension-free in order to avoid ticking of the pipes. The connections must not be twisted in order to avoid leaks at the joint points.
2. The CH system is recommended with:
  - A make up water loop in the system below the appliance as shown in figure 8.
  - A drain tap at the lowest point of the system.
  - An expansion tank (Follow section 1.4.1.4).
  - A check valve when pipes are running upward at a short distance from the appliance. This prevents gravity circulation during domestic hot water operation of the appliance.
3. Flush the CH system thoroughly after finishing the piping installation and purge trapped air.





### 1.4.1.2 PRESSURE RELIEF VALVE



#### **WARNING**

The pressure relief valve discharges pressurized hot water which can turn into steam. Steam exiting the discharge outlet can explosively expand in all directions. Always maintain a safe distance from the discharge pipe outlet in order to avoid potential contact with exiting hot water or steam and injury.

A pressure relief valve is supplied as standard equipment. The pressure relief valve is extra protection against damage that could be caused by malfunctioning controls or excessive water pressure. The pressure relief valve is a code requirement. Field installation of the relief valve must be consistent with the ANSI/ASME Boiler and Pressure Vessel Code, Section IV. The manufacturer is not responsible for any water damage. If a pressure relief valve is not used, the warranty is void.

The pressure relief valve should be installed on the boiler outlet with its spindle vertical. The connection between the boiler and the relief valve must have at least the area of the relief valve inlet. No valve should be installed between the pressure relief valve and the appliance or in the discharge piping.

A discharge pipe should be used. The discharge pipe outlet should be positioned over a suitable drain and so arranged that there will be no danger of being scalded. The discharge pipe must pitch down from the valve and should be no smaller than the outlet of the valve. The end of the discharge pipe should not be concealed or threaded and should be protected from freezing. Extensive runs, traps or bends could reduce the capacity of the pressure relief valve.

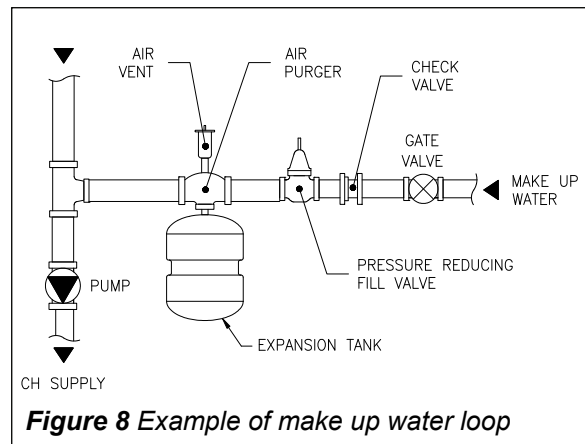
### 1.4.1.3 MANUAL SHUTOFF VALVES (Refer to Figure 7)

Install the manual shut off valves on the supply and return pipes.

### 1.4.1.4 EXPANSION TANK AND MAKE-UP WATER

The boiler requires an expansion tank which is of the adequate volume for the heating system. For larger volume systems, an additional expansion tank may be required. Consult heating system engineer and the expansion tank manufacturer for proper sizing information.

Install make-up water connections as per local codes. If a pressure reducing valve is used as shown in figure 8, adjust it to match the system fill pressure. Also adjust the diaphragm type expansion tank air pressure to match the system fill pressure. In connecting the cold make-up water supply to the appliance, make sure that clean water supply is available. When the water supply is from a well or pump, a sand strainer should be installed at the pump.



### 1.4.1.5 SYSTEM BYPASS AND PRESSURE HEAD LOSSES

A bypass (primary/secondary piping) is not required for the safe operation of the appliance. It may, however, be required in conjunction with certain controls on a heating system.

Pump head and pressure drop of the CH heat exchanger versus water flow rate are shown in Figure 30. To confirm if the equipped pump meets the system pressure drop or requires an additional system pump, the system pressure drop must be calculated by a qualified heating system designer.



### 1.4.1.6 CORROSION PREVENTION (Internal)

The use of oxygen barrier tubing is recommended to protect the system and its components (e.g. pump) from corrosion. Should your system include "non-oxygen barrier" tubing please contact the factory or a heating professional for recommendations.

If freeze protection is required, use an inhibited propylene glycol solution which is specifically designed for hydronic heating systems and always maintained at a neutral pH (e.g. Fernox Alpha-11 or equivalent). Follow the supplier's instructions for proper use and maintenance. Do not use automotive antifreeze.

Some types of chemical additives can cause problems (e.g. accelerated corrosion, reduced efficiency, etc.) and could result in premature failure of the boiler heat exchanger and/or system components, especially when not properly used or maintained. Corrosion is a preventable condition and is not covered by the product warranty.

### 1.4.2 DHW PIPING SYSTEM (WATER HEATER)

The appliance includes standard parts for connection to a central heating (CH) system. For connection to domestic hot water heating (DHW) system, the DHW kit must be used with the appliance and can be supplied upon request.

#### 1.4.2.1 DHW PIPING CONNECTIONS

1. Piping and components connected to the water heater shall be suitable for use with potable water.
2. Flush the hot and cold water system thoroughly to clean out metal powder, sand and dirt before connecting it.
3. Use compression fittings supplied to connect the DHW supply and return pipes (refer to Figure 7). Check whether the compression rings are straight in the connectors. All pipes must be installed tension-free in order to avoid ticking of the pipes. The connections must not be twisted in order to avoid leaks at the joint points.
4. Test that there are no water leaks from the cold and hot water supply pipes and then insulate all water piping especially the hot supply and recirculation water lines, and cold water pipe according to the climate of the region or local code to prevent the pipe from freezing. Do not cover the drain or pressure relief valve.



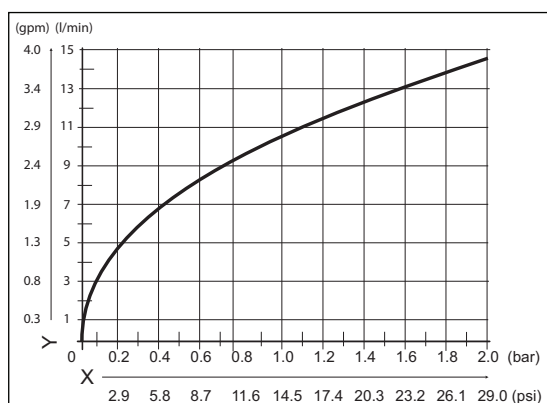
#### **WARNING**

Potential Scald Hazard. A thermostatic mixing valve must be used to prevent potential scalding hazards that may result in severe personal injury or death.

When the appliance is used for hot water supply only in the summer, the CH heating function can be switched off with the service code on the operating panel.

If the appliance is shutdown during the winter, the domestic hot water and heating water loops should be drained to prevent the pipes from freezing. Also disconnect the make up water for the CH heating loop and cold water for the domestic hot water at the bottom of the appliance.

Figure 9 shows the domestic hot water flow rate versus the cold water pressure  $\pm 10\%$ .



**Figure 9 DHW flow rate vs. water pressure**

### 1.4.2.2 DHW PIPING WITH A BACKFLOW PREVENTER

If the water heater is installed in a closed water supply system, such as one having a backflow preventer in the cold water supply line, means shall be provided to control thermal expansion. Contact the water supplier or local plumbing inspector on how to control this situation.

### 1.4.2.3 PRESSURE RELIEF VALVE OR TEMPERATURE AND PRESSURE RELIEF VALVE

A pressure relief valve must be installed near the domestic hot water outlet. If the unit is connected to a separate storage vessel, the separate vessel must have its own temperature and pressure relief valve. The pressure relief valve or temperature and pressure relief valve must be rated in accordance with and comply with the Standard for Relief Valves for Hot Water Supply Systems, ANSI Z21.22/CSA 4.4 or the ANSI/ASME Boiler and Pressure Vessel Code, Section IV ("Heating Boilers").

The location of the relief valve shall be accessible for servicing or replacement. If a separate storage vessel is installed, it shall have a tapping separate from the tapping for the water connections to accommodate a temperature and pressure relief valve of adequate size to protect the water heater. This tapping shall be clearly identified on Class III marking material and shall be located in the top of the tank, or in the side of the tank on a centreline within the upper 6 inches of the top of the tank. The tapping shall be threaded in accordance with the Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1.

The maximum Btu/h discharge capacity of the pressure relief valve must be at least equal to the maximum input rating of the water heater. The maximum relieving pressure setting must not exceed 150 psi (10.3 bar). No valve shall be placed between the relief valve and the water heater, relief valve and the storage tank, or in the discharge pipe as shown in figure 7.

Avoid contact with the hot water and steam discharged to prevent personal injury. The discharge pipe outlet should be positioned over a suitable drain within 6" (152 mm) from the floor. It must be arranged so that there will be no danger of being scalded and the hot water cannot splash on anyone or nearby equipment.

The discharge pipe must pitch down from the valve and should be no smaller than the outlet of the valve. The end of the discharge pipe should not be concealed or threaded and should be protected from freezing. Extensive runs, traps or bends could reduce the capacity of the pressure relief valve. No reducing coupling or other restriction can be installed in the discharge line.

If a relief valve discharges periodically, this may be due to thermal expansion in a close water supply system. Contact the water supplier or local plumbing inspector on how to correct this situation. Do not plug the relief valve.

### 1.4.2.4 CATHODIC PROTECTION DEVICES

When cathodic protection devices are used in the storage tank, hydrogen gas can be produced in a hot water system that has not been used for a long period of time (generally two weeks or more). Hydrogen gas is extremely flammable. To prevent the possibility of injury under these conditions, we recommend the hot water faucet be open for several minutes at the kitchen sink before you use any electrical appliance which is connected to the hot water system. If hydrogen is present, there will probably be an unusual sound as air escaping through the pipe as the hot water begins to flow. There should be no smoking or open flame near the faucet when it is open.

### 1.4.3 APPLIANCE USED WITH SOLAR SYSTEMS

This appliance is suitable for use with solar hot water systems and can be buffered using a *Super Hot* storage tank or indirect hot water tank. Contact Allied Engineering Company for details.

## 1.5 GAS SERVICE PIPING

All piping and fittings must be installed as per codes in *Section 1.2*. Make sure the gas on which the appliance will operate is the same as that specified on the appliance rating plate. Do not install the appliance if equipped for a different type gas. Consult your gas supplier to get gas information.

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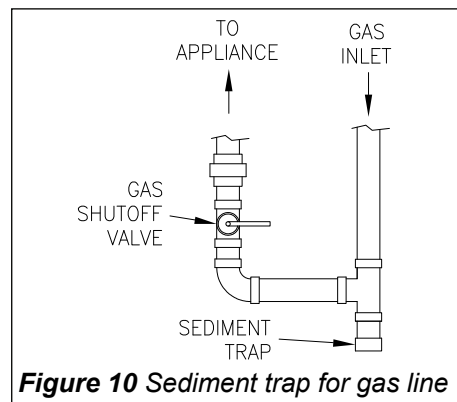
To prevent damage, care must be taken not to apply too much torque when connecting pipe fitting of gas supply to gas inlet pipe on the appliance. A manual main shut-off valve must be installed in the gas line outside the appliance jacket and as required in *Section 1.2*. The valve should be readily accessible for turning on and off.

When a vertical section of gas piping is supplied on the upstream side of the gas controls, a drip pocket or sediment trap must be installed at the inlet of gas connection to the appliance (in the gas supply line upstream of the gas controls and as close to the appliance as possible), example shown in Figure 10.

The appliance and its gas connection must be leak tested before placing the appliance in operation. The gas controls furnished are suitable for a maximum operating gas pressure of 1/2 psi (14 inches water column/356 mm water column).

The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (14 inches water column/356 mm water column).

The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing at test pressures equal to or less than 1/2 psig (14 in. water column/356 mm water column).



**Figure 10** Sediment trap for gas line

The pipe compound used should be resistant to the action of liquefied petroleum gases. Check for gas leaks in piping, connection to appliance, and gas valve inlet before placing the appliance in operation by using a soap and water solution. Also check for gas leaks at the gas valve outlet when the appliance is on. **DO NOT USE AN OPEN FLAME.**

**INSTALLER MUST IDENTIFY EMERGENCY SHUT-OFF DEVICES.**

### 1.6 ELECTRICAL CONNECTION



**WARNING** Electrical shock hazard can cause severe injury or death. Disconnect power before installing or servicing.

The appliance requires a 120 Vac 60 Hz power supply, and must be grounded. All electrical connections must be made in full accordance with the Code requirements listed in Section 1.2.

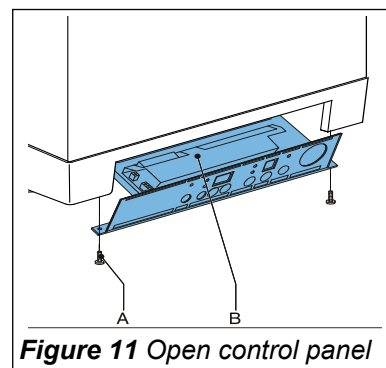


**WARNING** Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

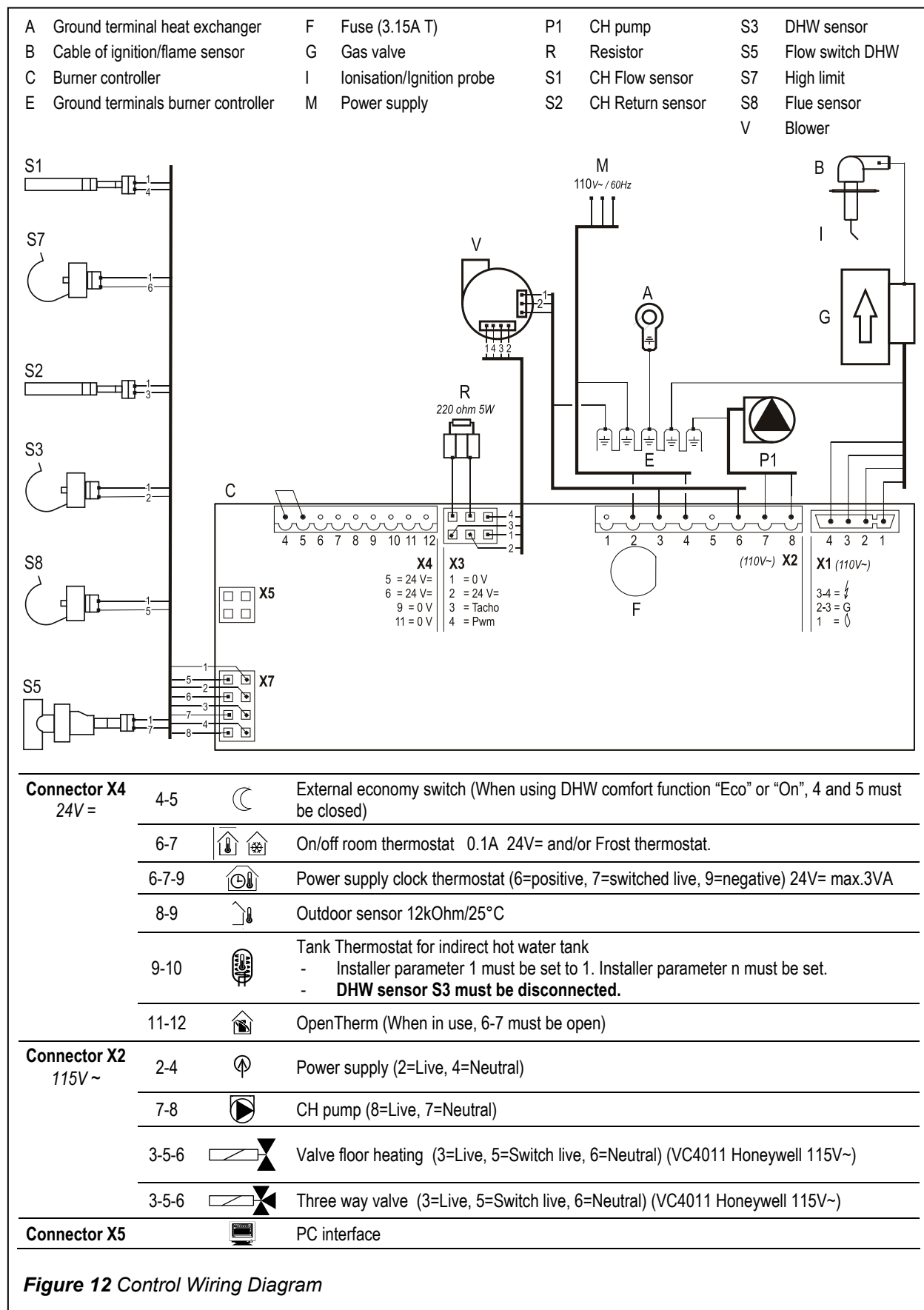
Run a separate electrical circuit from the electrical service panel through a fused disconnect switch to the appliance. This appliance must be electrically bonded to ground in accordance with the requirements of the authority having jurisdiction (local codes) or, in the absence of such requirements, with the *National Electrical Code, ANSI/NFPA 70* (current edition) and/or the *Canadian Electrical Code, CSA C22.1 Part 1* (current edition). Field wiring shall conform to *Section 2.2* and to the temperature limitations of Type T [63°F (35°C) rise or better.

Make wiring connections as follows:

1. Unscrew the screws (A) in order to gain access to the space of the appliance controller (B). Refer to Figure 11.
2. The cover plate (display) hinges open downwards to access to the controller and electrical connections.
3. Refer to electrical wiring diagram in Figure 12 to make the electrical connections.
4. After making the required connections, replace the appliance controller.



**Figure 11** Open control panel



### 1.7 VENTING AND COMBUSTION AIR

#### DEFINITIONS

A <b>direct</b> vent (a balanced flue) appliance – an appliance that operates with all air for combustion obtained from the <i>outdoor atmosphere</i> and all flue gases discharged to the outdoor atmosphere.
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A <b>non-direct</b> vent appliance – an appliance that operates with all air for combustion obtained from the <i>boiler room</i> and all flue gases discharged to the outdoor atmosphere.
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This appliance is certified as a direct vent appliance only. The venting system must be installed in accordance with this manual and the venting manufacturer's certified installation instructions.

Provision for combustion and ventilation air must be met in accordance with Chapter 5.3, Air for Combustion and Ventilation and Chapter 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 in USA, and Section 7, Venting Systems and Air Supply for Appliances, of the Natural Gas and Propane Installation Code, CAN/CSA B149.1 in Canada. Also, applicable provisions of the local building codes must be followed. Contact local building or fire officials about restrictions and installation inspection in your area. If there is any conflict in the above Code requirements, the more stringent requirement applies.

For a direct vent appliance installation, sufficient air for ventilation in the appliance room or closet should be provided from indoors to reduce the room air temperature.

The air supply and venting terminations must always be kept clear of obstructions (i.e. snow, ice, etc.).

The responsibility of providing a suitable venting and air intake tube of adequate draft capacity and in good usable condition is that of the gas fitter/installer. Interference with the air supply for the appliance shall be prohibited.

#### Removal of an Existing Boiler

When an existing appliance is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances connected to it.

At the time of removal of an existing appliance, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- a) Seal any unused openings in the common venting system.
- b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- c) Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- d) Place in operation the boiler being inspected. Follow the lighting instructions. Adjust the thermostat so the appliance will operate continuously.
- e) Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
- f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous conditions of use.
- g) Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code, ANSI Z223.1* and/or the *Natural Gas and Propane*

*Installation Code, CAN/CSA B149.1.* When re-sizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* and/or the *Natural Gas and Propane Installation Code, CAN/CSA B149.1.*

### 1.7.1 CORROSIVE ATMOSPHERE

If the appliance is to be installed near a corrosive or potentially corrosive air supply, the appliance must be isolated from it and outside air must be supplied as a direct venting system.

Chemical vapors from products containing **chlorine** or **fluorine** must be avoided. Even though these chemicals may be safe to breathe, corrosive substances can become liberated when passed through a gas flame. Even at low concentrations, these chemicals can significantly contaminate the air supply and shorten the life of any gas-fired appliance. The following is a list of some of the products which should be avoided:

- bleaches and chlorinated cleaning products
- paints and sprays
- water softeners (calcium or sodium chloride)
- leaking refrigeration equipment
- Freon from common aerosol dispensers

These chemicals are especially common near swimming pools, beauty shops, dry cleaning establishments, laundry areas, workshops, and garages. The warranty is void when failure is due to corrosion.

### 1.7.2 AIR INTAKE SYSTEM

For a direct vent system, DWV (drains, waste, vents) PVC, CPVC, ABS, galvanized steel tube, and flex aluminum tube can be used for the air intake system. Do not use these materials for the exhaust vent system. ULC S636 PVC and CPVC or stainless steel tube may also be used for the air intake system. The air intake tube and its joints should be sealed using appropriate sealants when necessary.

### 1.7.3 EXHAUST VENT SYSTEM



#### **WARNING**

Failure to comply with these instructions may result in a failure of venting system and leakage of flue products to the living space. Only certified PP, CPVC or stainless steel may be used to vent this appliance. Do not use cellular core for vent piping. Follow vent manufacturer's recommendations for vent installation.



#### **WARNING**

Venting and components (e.g. elbows, primer, cement) are to be installed as a *system* as per the vent manufacturer's installation instructions. Do not mix and match components from different vent systems.

This appliance will produce some condensate with a positive vent static pressure during operation and therefore an air-tight and anti-corrosion venting system must be used. Use only certified PP, CPVC or stainless steel exhaust venting which has been approved. The following manufacturers offer venting and components approved for use with this appliance:

**CPVC** schedule 40 venting tube and components:

- In Canada, IPEX: System CPVC or certified type of ULC S636
- In USA, ANSI/ASTM F441, CPVC schedule 40 or certified type

**PP** venting tube and components:

- In Canada, M&G: PP system, certified type of ULC S636
- In USA, ANSI/ASTM, PP system, certified type

**Stainless steel** venting tube and components (certified types for Category IV):

- Flexmaster Canada Ltd.: Z-Vent
- Z-Flex U.S., Inc.: Z-Vent
- Heat-Fab Inc.: Saf-T-Vent
- Flex-L International Inc.: StaR-34
- Protech Systems, Inc.: FasNSeal™

The use of these manufacturers' venting systems for sidewall venting will require the use of a vent terminal specified by Allied Engineering Company. The vent terminal for a vertical venting system should be obtained from the supplier of the venting system listed above.

### 1.7.4 VENT TERMINAL INFORMATION

The minimum distance from the vent terminal to adjacent public walkways, adjacent buildings, operable windows and building openings shall be not less than those values specified in the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* and/or the *Natural Gas and Propane Installation Code, CAN/CSA B149.1*.

Flue gas condensate can freeze on the exterior walls or on the vent termination. Frozen condensate on the vent cap can result in a blocked flue condition and should be removed to keep the appliance operating normally.

Some discoloration to exterior building surfaces can be expected. Adjacent brick or masonry surfaces should be protected with a rust resistant sheet metal plate. To prevent discoloration and degradation of building materials by flue gases and flue gas condensation, ensure that the vent terminal is installed clear of nearby obstacles. In all cases, installation shall be in accordance with applicable code(s).

For proper operation, the vent terminal must be kept free of snow, leaf dropping and other debris at all times to ensure that no blockage occurs.

Do not terminate the vent in a window well, stairwell, alcove, courtyard, or other recessed area. The vent cannot terminate below grade and over paved walkways or paved driveway that is located between two single-family dwellings and serves both dwellings, or near soffit vents or crawl space vents or other area where condensate or vapor could create a nuisance or hazard or cause property damage; or where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment. The vent shall not terminate underneath a veranda, porch, or deck unless the veranda, porch, or deck is fully open on a minimum of two sides beneath the floor and the distance between the top of the vent termination and the underside of the veranda, porch, or deck is greater than 1 foot (300 mm).

Do not locate the vent terminal directly under roof or deck overhangs to prevent icicles from forming. Due to the low flue gas temperature, 'pluming' will occur at the flue terminal. Care should be taken to ensure that the discharge plume will not cause annoyance to the neighbors. Therefore, never allow vent terminal towards neighbor's windows or where personal injury or property damage can occur.

The terminal shall not be installed in any area which is not allocated to the occupancy in which the appliance is installed.

In a structure with three walls and a roof, the terminal shall not be installed:

- a) more than 72 inches (1.8 m) from the outside opening;
- b) on any wall that has an opening between the terminal and the open side of the structure.

It is highly recommended that the vent terminal be located where it will not be exposed to normal prevailing winds.

The vertical termination shall extend to the required height above the highest point where it passes through the roof of the building and located higher than any portion of a building within a horizontal distance of the required distance, or specified as local jurisdiction.

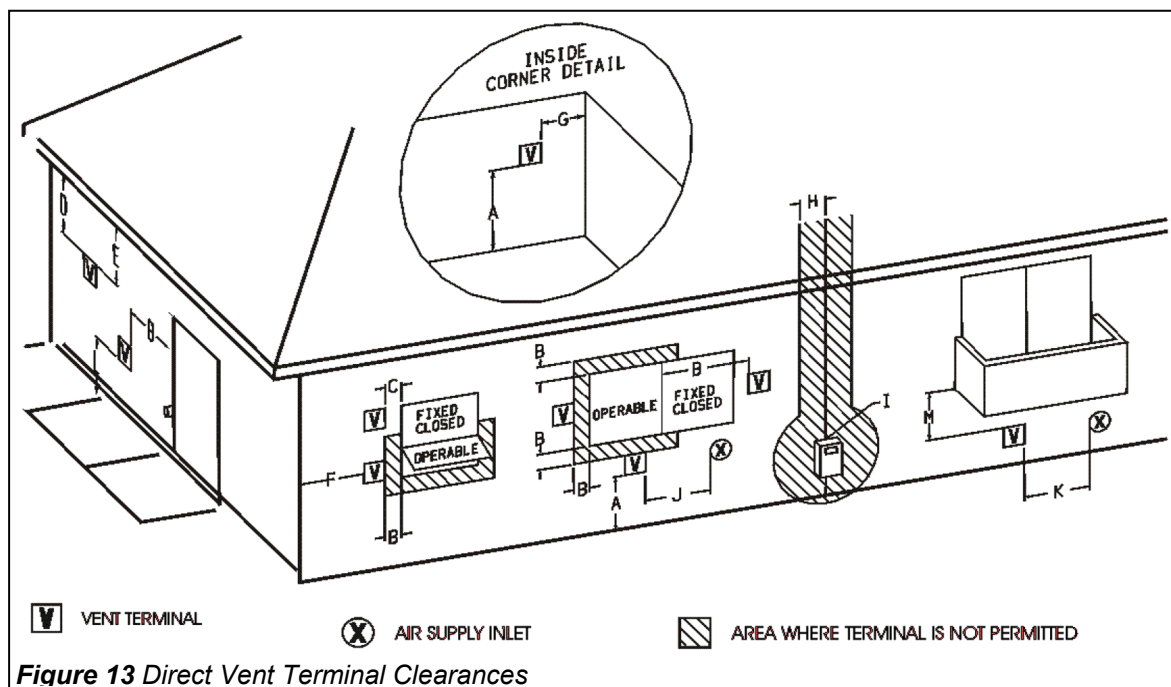
The vent terminal shall be located at a certain distance from any building opening and above any mechanical air supply inlet to any building.

**Gas service meters:** The vent shall not terminate within 3 feet (0.9 m) of any gas service regulator vent outlet and mechanical air inlet to building requires a clearance of 10 feet (3.0 m) from any *gas service regulator internal relief vent*. Vents are prohibited above the gas meter assembly (not propane regulator vents) within 3 feet (0.9 m) horizontally of the vertical center line of the regulator to a vertical distance of 15 feet (4.6 m).

The bottom of the vent terminal and the air intake shall be located at least 12 inches (0.3 m) above grade plus height of the normal snow line.

The terminal shall not be less than 7 feet (2.1 m) above grade where located adjacent to a public walkway and shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance of hazard or could be detrimental to the operation of regulators, relief valves, or other equipment.

The diagram as shown in Figure 13 indicates vent terminal clearances A to M for a direct vent appliance. The clearance marked on the diagram are stated separately in Table 2 for US and Canadian installations and shall not be less than those specified in the current *ANSI Z223.1/NFPA 54 National Fuel Gas Code* or *CSA-B149.1, Natural Gas and Propane Installation Codes*, as applicable. For clearances not specified in ANSI Z223.1/NFPA 54 or CSA-B149.1, the clearances shall be in accordance with local installation codes and the requirements of the gas supplier.



**Figure 13** Direct Vent Terminal Clearances



## HSE Installation and Service Manual

**Table 2 Direct Vent Terminal Clearances (Refer to Figure 13)**

	Canadian Installations <sup>1</sup>	US Installations <sup>2</sup>
A= Clearance above grade, veranda, porch, deck, or balcony	12 inches (30 cm)	12 inches (30 cm)
B= Clearance to window or door that may be opened	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 inches (91 cm) for appliances >100,000 Btuh (30 kW)	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 inches (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 inches (30 cm) for appliances > 50,000 Btuh (15 kW)
C= Clearance to window or door that may be opened	*	*
D= Clearance to permanently closed window	*	*
E= Clearance to unventilated soffit	*	*
F= Clearance to outside corner	*	*
G= Clearance to inside corner	*	*
H= Clearance to each side of center line extended above meter/regulator assembly	3 feet (91 cm) within a height 15 feet above the meter/regulator assembly	*
I= Clearance to service regulator vent outlet	3 feet (1.83 m)	*
J= Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 inches (91 cm) for appliances >100,000 Btuh (30 kW)	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 inches (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 inches (30 cm) for appliances > 50,000 Btuh (15 kW)
K= Clearance to a mechanical air supply inlet	6 feet (1.83 m)	3 feet (91 cm) above if within 10 feet (3 m) horizontally
L= Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.13 m) †	*
M= Clearance under veranda, porch deck, or balcony	12 inches (30 cm) ‡	*

<sup>1</sup> In accordance with the current *CSA B149.1 Natural Gas and Propane Installation Code*

<sup>2</sup> In accordance with the current *ANSI Z223.1 / NFPA 54 National Fuel Gas Code*

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

\* For clearances not specified in ANSI Z223.1 / NFPA 54 or CSA-B149.1, one of the following shall be indicated:

a) A minimum clearance value determined by testing, or;

b) A reference to the following footnote:

“Clearance in accordance with local installation codes and the requirements of the gas supplier.”

### 1.7.5 DIRECT VENT CONFIGURATIONS



#### **WARNING**

Failure to ensure that tubes are connected, seated or sealed properly may result in leakage and eventual failure of the sealing gasket.

Five venting configurations are available for the appliance:

#### Twin Tube

- 3 inch CPVC twin tube venting system with 80 mm to 3 inch CPVC adapters
- 3 inch stainless steel twin tube venting system with 80 mm to 3 inch stainless steel adapters
- 80 mm PP twin tube venting system, adapter not required

#### Concentric

- 80 mm/125 mm PP concentric venting system with a concentric adapter

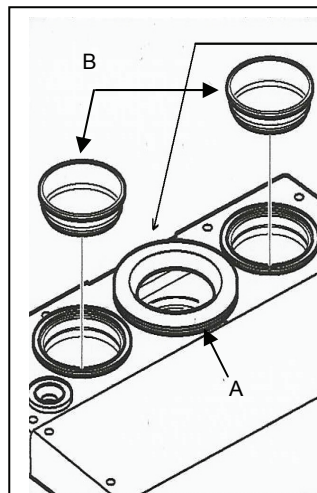
#### Combination

- 80 mm PP twin tube venting joined to 80 mm/125 mm PP concentric venting system using a twin tube to concentric adapter

#### 1.7.5.1 TWIN TUBE TO APPLIANCE CONNECTION (Refer Figure 14)

1. Right-hand air supply is for standard installation. The sealing cap must be removed, if there is one.

2. Install the tubes or adapters (if required) into air supply opening and the flue collar on the top of the appliance. The built in sealing rings provide airtight connections. The joints of air supply tubes should be sealed by silicone or other means. The flue tubes should be sealed following flue tube supplier's installation instructions.



**Figure 14** Air supply and flue openings

#### 1.7.5.2 CONCENTRIC TO APPLIANCE CONNECTION (Refer to Figure 15)

1. Properly seal the air supply opening on the appliance with the sealing cap supplied with the set (item B in Figure 14)

2. Replace the existing sealing ring (item A) on the top of the appliance, as shown in Figure 14, by the sealing ring  $\varnothing$  116 x 110 mm (4.6 in x 4.33 in) which should be provided by manufacturer.

3. Fit the adapter on the flue discharge.

4. The venting tubes should be sealed following venting tube supplier's installation instruction.



#### **CAUTION:**

**In Canada, follow CAN/CSA B149.1 (current edition) and/or local code requirements for use of plastic venting**

Plastic vents shall be installed such that the first 3 feet (92 cm), or total vent run if less than 3 feet (92 cm) from the appliance flue outlet, is readily accessible for visual inspection. (CAN/CSA B149.1, clause 8.9.5)

## 1.7.6 EQUIVALENT VENT/AIR INTAKE TUBE LENGTH AND DIAMETERS

The resistance of the combustion air supply and the flue gas tubes depends on the length, the diameter, components used and venting configuration of the venting system. For the appliance to operate normally, the venting system, including air intake piping, flue tube and terminal, must not be overly restrictive. Use Table 3 to determine the venting system equivalent length for a specified vent configuration. The equivalent venting system length of your installation must be within the maximum and minimum allowable length specified in Table 3. Use the notes in Table 3 to calculate your venting systems equivalent length in feet based on the total centerline length and number of elbows for air supply piping and exhaust vent.

**Table 3** Equivalent Venting System Length for HSE-125

MODEL	<b>Direct Vent: Twin Tubes Equivalent Length of Air and Flue Tubes in Feet/m</b>				<b>Direct Vent: Concentric Tubes Equivalent Length of Air and Flue Tubes in Feet/m</b>			
	3" diameter (80mm) (vertical runs)		3" diameter (80mm) (horizontal runs)		3"/5" diameter (80mm/125mm) (vertical runs)		3"/5" diameter (80mm/125mm) (horizontal runs)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
<b>AIR TUBE</b>	5 ft/ 1.52 m	85 ft/ 26 m	5 ft/ 1.52 m	85 ft/ 26 m	5 ft/ 1.52 m	85 ft/ 26 m	5 ft/ 1.52 m	85 ft/ 26 m
<b>FLUE TUBE</b>	5 ft/ 1.52 m	85 ft/ 26 m	5 ft/ 1.52 m	85 ft/ 26 m	5 ft/ 1.52 m	85 ft/ 26 m	5 ft/ 1.52 m	85 ft/ 26 m
<b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Choose the right appliance <b>vent outlet adapter</b> (if required) for plastic or stainless steel vent tube for twin tube or concentric tube venting.</li> <li>2. Reduce the equivalent length by <b>6.5</b> feet (2 m) for each 90-degree elbow added and by <b>3.5</b> feet (1.1 m) for each 45-degree elbow for your estimating the equivalent venting lengths.</li> <li>3. Always confirm with the selected venting manufacturer for the actual equivalent length of elbows.</li> </ol>								

**Table 3a** Equivalent Venting System Length for HSE-145

MODEL	Direct Vent: Twin Tubes Equivalent Length of Air and Flue Tubes in Feet/m				Direct Vent: Concentric Tubes Equivalent Length of Air and Flue Tubes in Feet/m			
	3" diameter (80mm) (vertical runs)		3" diameter (80mm) (horizontal runs)		3"/5" diameter (80mm/125mm) (vertical runs)		3"/5" diameter (80mm/125mm) (horizontal runs)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
AIR TUBE	5 ft/ 1.52 m	60 ft/ 20 m	5 ft/ 1.52 m	60 ft/ 20 m	5 ft/ 1.52 m	60 ft/ 20 m	5 ft/ 1.52 m	60 ft/ 20 m
FLUE TUBE	5 ft/ 1.52 m	60 ft/ 20 m	5 ft/ 1.52 m	60 ft/ 20 m	5 ft/ 1.52 m	60 ft/ 20 m	5 ft/ 1.52 m	60 ft/ 20 m
<b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Choose the right appliance <b>vent outlet adapter</b> (if required) for plastic or stainless steel vent tube for twin tube or concentric tube venting.</li> <li>2. Reduce the equivalent length by <b>6.5 feet (2 m)</b> for each 90-degree elbow added and by <b>3.5 feet (1.1 m)</b> for each 45-degree elbow for your estimating the equivalent venting lengths.</li> <li>3. Always confirm with the selected venting manufacturer for the actual equivalent length of elbows.</li> </ol>								

## 1.7.7 EXAMPLE OF 3 INCH DIAMETER TWIN TUBE CALCULATION

**Table 4** Example Calculation (Refer to Figure 15)

TUBE TYPE	TUBE LENGTHS	TOTAL TUBE LENGTHS
Flue Tube	L1 + L2 + L3 + 2x6.5feet	40 feet (12.2 m)
Air Supply Tube	L4 + L5 + L6 + 2x6.5feet	40 feet (12.2 m)
Total Length		80 feet (24.4 m)

## 1.7.8 EXAMPLE OF 3/5 INCH (80mm/125mm) DIAMETER CONCENTRIC TUBE CALCULATION

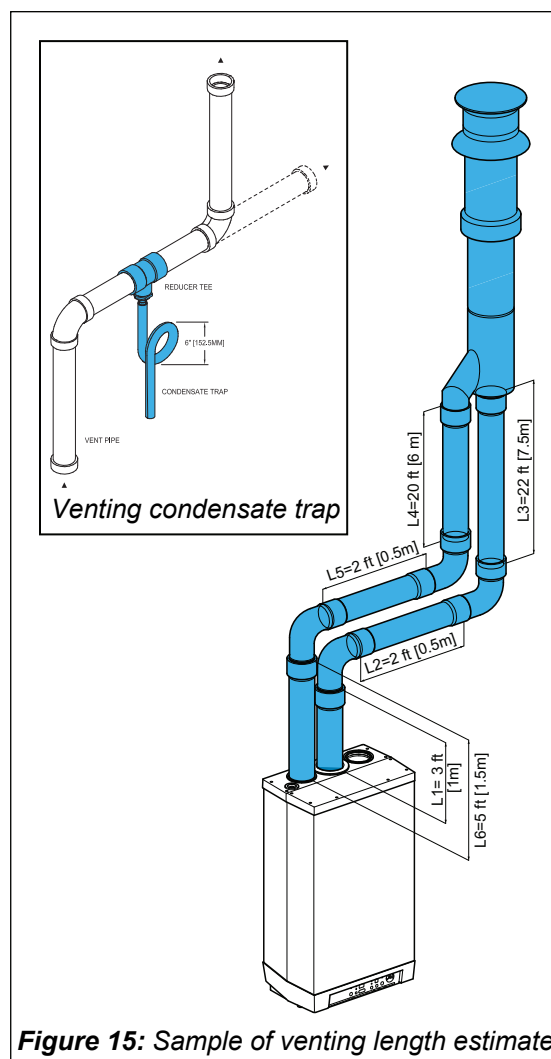
With 3 elbows at 90-degree, the maximum straight length of concentric tube that can be used is:

$$85 \text{ feet} - 3 \times 2 \times 6.5 \text{ feet} = 46 \text{ feet (14 m).}$$

## 1.7.9 VENT INSTALLATIONS

The following installation procedure is a guide for all vent installations:

1. The appliance must be vented to the outdoors. Do not install the vent into a common venting system. The venting system does not require a vent damper.
2. When the straight flue pipe is over 9.5 feet (3 m), a venting condensate drain and trap should be installed. The venting condensate drain should be installed as close to the appliance as possible and must be equipped with a drain trap. The drain trap can be formed by attaching 1/2" (13 mm) diameter flexible tubing to the drain assembly, making a loop of approximately 6" diameter and securing it with a cord or tie wrap where the tube crosses over itself. Do not squash the tube or over-tighten it, see Figure 15, or use other type of boiler condensate trap. The loop or condensate trap must then be filled with water to form a liquid-filled trap. This trap allows condensate to drain while preventing exhaust gases from escaping. The condensate should be discharged as per section 1.3.7.
3. Always select the venting systems, including the terminals, approved for use with this type of appliance.
4. Follow the vent manufacturer's instructions or applicable codes to install the venting system, proper venting adapters, spacers, thimbles, caps, roof flashing, storm collar, supports, terminal(s), etc and support the venting system so that its weight does not bear on the appliance.
5. Provide minimum service clearance from vent components to the wall as specified in the section 1.3.
6. The vent system has a positive pressure in the flue requiring that all vent joints and seams be properly cleaned and sealed gas-tight by following the vent manufacturer's instructions. Also, seal the joints of tube/storm collar and flashing/storm collar with waterproof caulking for a vertical venting installation.
7. Increasing the length of the exhaust vent run will increase the amount of condensate. The condensate of the exhaust is acidic and can cause severe corrosion of ordinary venting materials. Also, appliance operation can be affected by restrictive vent or combustion air supply piping. Therefore, venting lengths must be within the specified minimum and maximum equivalent venting system length in Table 3.
8. Slide the adapters (if required) or air supply and flue tubes into the combustion air intake and flue outlet of the appliance so that the gaskets seal snugly around the adapter. Ensure that there are no gaps or leaks.
9. Connect the required combustion air and vent tubes to the adapters (if installed) by following the vent manufacturer's instructions and applicable code(s).

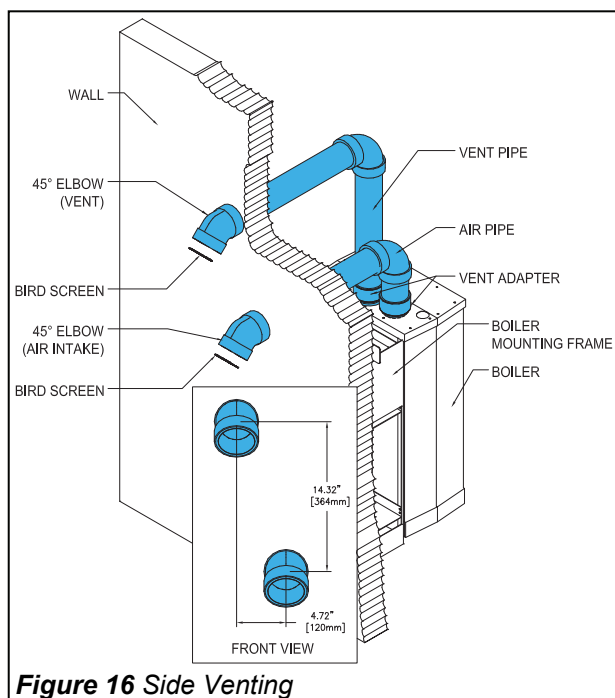


**Figure 15: Sample of venting length estimate**

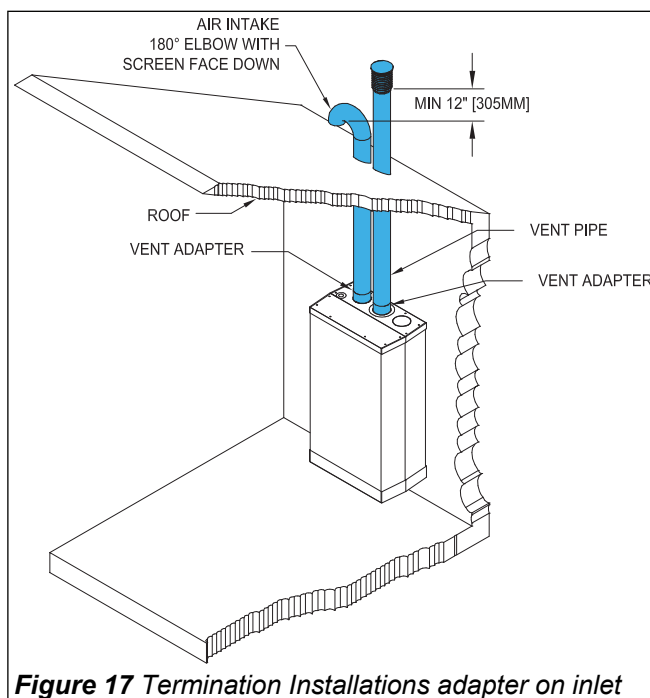
10. Generally, all vent tubes must be adequately supported with vent supports no less than five feet (1.5 m) apart or as per the vent system manufacturer's instructions or applicable code(s), and at smaller intervals if necessary to ensure that there are no sagging sections along the horizontal runs. **Do not use the appliance to support the weight of the venting.** Noncombustible tube strap or hangers suitable for the weight can be used to support horizontal runs and maintain vent location.
11. Horizontal venting tube runs must always be installed with a slope upwards not less than  $\frac{1}{4}$  in/ft (2 cm/m) from the appliance to the vent terminal. This is to ensure that any condensate in the venting flows back towards the appliance so that the condensate can be disposed of through the condensate trap system installed on the bottom of appliance or at the down end of the horizontal portions of the venting system. This will prevent condensation from gathering in the venting tube and will also reduce the chance of icicles forming over horizontal tube ends in the winter.

### 1.7.9.1 HORIZONTAL TWIN TUBE SIDE VENTING WITH TWIN TERMINAL CAPS

Figure 16 is a typical installation for a side venting installation using two 45° elbows as twin terminal caps and adapters (if required) for air inlet and flue outlet on the appliance. A space between the two terminal caps is required as shown in Figure 16.



**Figure 16** Side Venting



**Figure 17** Termination Installations adapter on inlet

### 1.7.9.2 VERTICAL (ROOF TOP) TWIN TUBE VENTING WITH TWIN TERMINAL CAPS

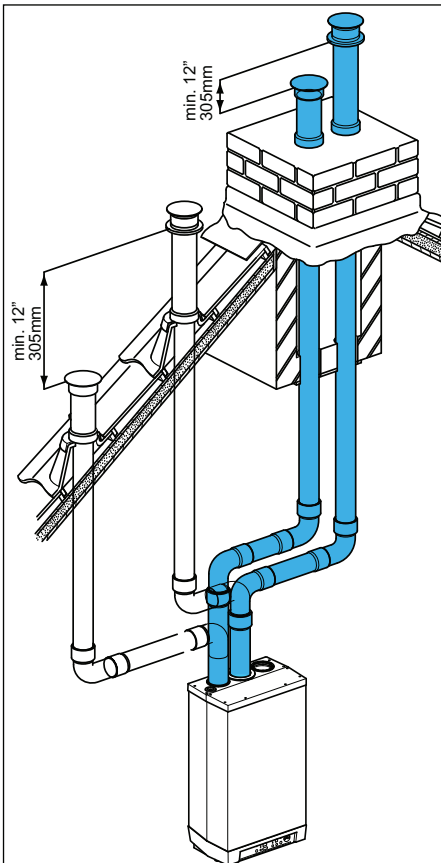
Figures 17 to 19 are typical installations for the vertical twin tube venting with twin terminal caps and adapters (if required) for air inlet and flue outlet on the appliance.

Location of the venting terminal has to be determined based on the applicable code before installing the terminals. Keep the end opening of air terminal at least 12 inches (300 mm) above the normal snow accumulation that can be expected on the roof and the top of the vent terminal at least 12 inches (300 mm) above the air inlet terminal opening. Support the venting on the outside of the roof if necessary or based on the code requirements.

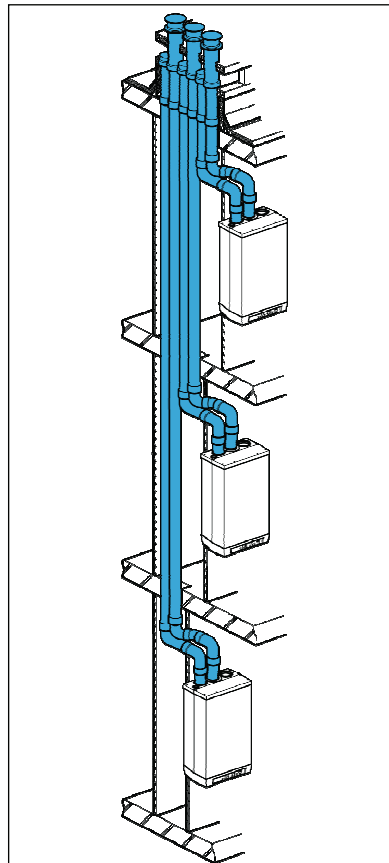
### 1.7.9.3 VERTICAL (ROOF TOP) TWIN TUBE VENTING WITH AIR SUPPLY FROM SIDE WALL

A typical installation of a vertical twin tube venting configuration with air supply from side wall is shown in Figure 20. Install side air supply tube/terminal. The air supply terminal (A) in Figure 20 can be located on the outside wall.

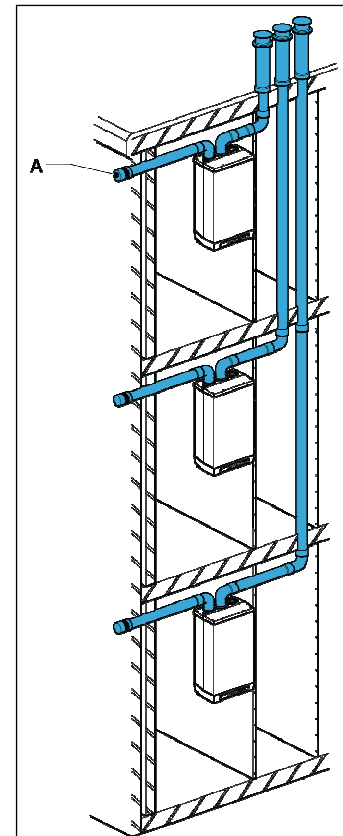
Location of the venting terminal must be determined based on the applicable code before installing the terminals.



**Figure 18** Vertical Twin Tube Venting



**Figure 19** Vertical Twin Tube Venting



**Figure 20** Vertical Single Venting with Side Air Supply

### 1.7.9.4 CONCENTRIC CONNECTIONS WITH A COMBINED TERMINAL CAP



**CAUTION:**

**In Canada, follow CAN/CSA B149.1 (current edition) and/or local code requirements for use of plastic venting**

Plastic vents shall be installed such that the first 3 feet (92 cm), or total vent run if less than 3 feet (92 cm) from the appliance flue outlet, is readily accessible for visual inspection. (CAN/CSA B149.1, clause 8.9.5)

Location of the venting terminal for vertical venting system has to be determined based on the applicable code before installing the terminals.

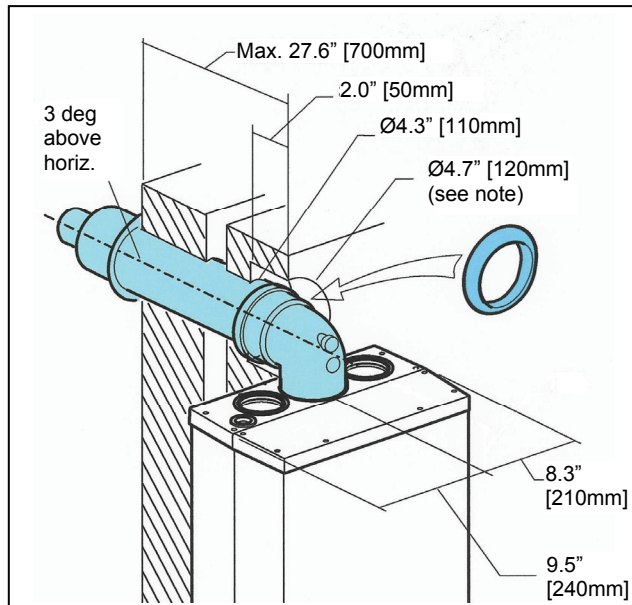
#### **Total Concentric Horizontal or Vertical Connection (Figure 21 and 24)**

Figures 21 and 24 are typical installations for the total concentric horizontal and vertical venting systems with a combined terminal cap and a concentric adapter for air inlet and flue outlet on the appliance. The adapter installation which requires change of the sealing ring referred to in section 1.7.5.2.

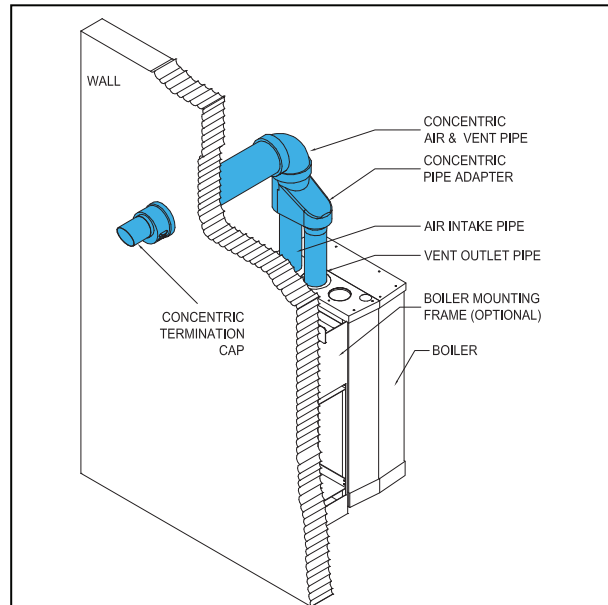
#### **Combination Twin Tube and Concentric Connection (Figure 23 and 24)**

Figures 22 and 23 are typical installations for combination twin tube to concentric pipe using a twin tube to concentric adapter and concentric terminal cap.

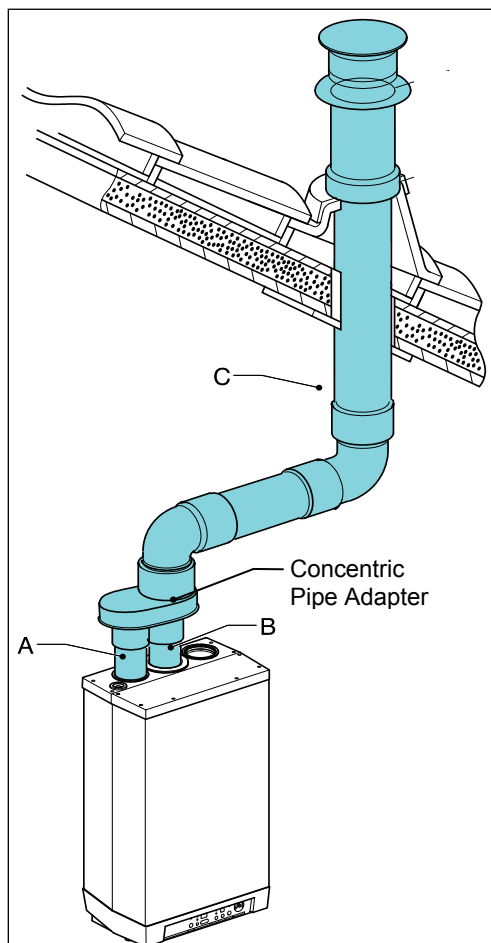




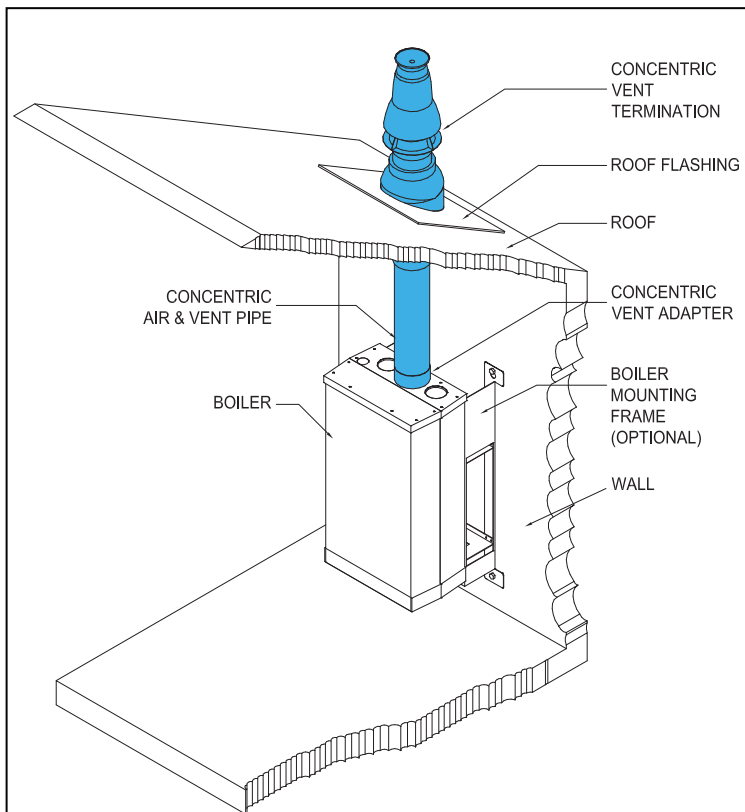
**Figure 21** Horizontal Concentric Venting



**Figure 22** Horizontal Twin Pipe to Concentric



**Figure 23** Vertical Twin Pipe to Concentric Venting



**Figure 24** Vertical Concentric Venting

### 2.1 CONTROLLER OPERATION

The appliance uses a microprocessor based controller to manage all functions including ignition and flame supervision, continuously modulating/monitoring each heat demand from the heating system or from the domestic hot water supply. The pump starts running when there is a heat demand from the heating system. The overrun time, which has a default of one minute, can be changed from 0 to 15 minutes if necessary (see setting and adjustment of section 2.4, refer to parameter 8). Also, the controller will automatically run the pump for 10 seconds once every 24 hours to prevent it from getting seized.

There are two supply temperatures set with a default in the controller memory; one is for Central Heating (CH) and the other for Domestic Hot Water supply (DHW). If an outdoor temperature sensor is connected to the appliance, the CH heating supply set point will automatically adjust as the outdoor temperature changes. For more information about the outdoor reset feature, see the section 2.4.3 and 2.4.6.

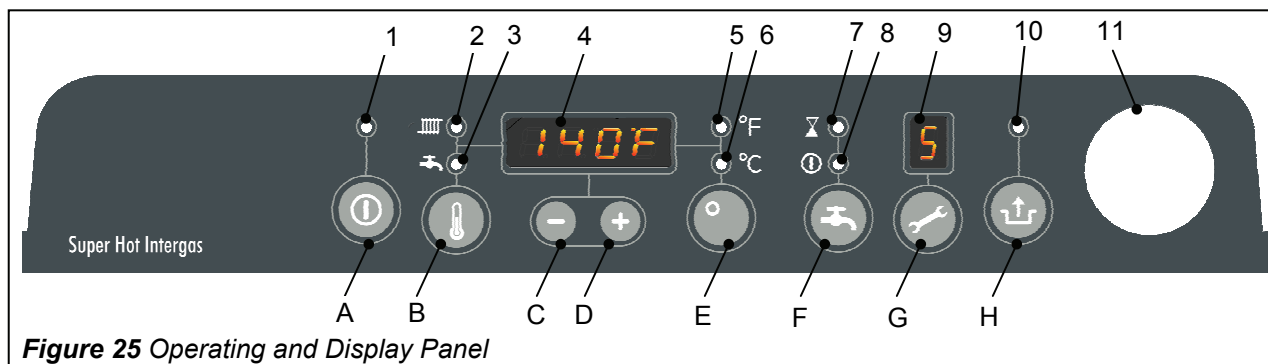
The controller modulates the appliance input rate by changing the blower speed based on both the difference between supply and return temperatures and the set point temperature. The amount of gas induced into the blower will depend on the blower speed that has been designed to maintain an approximately constant air-fuel ratio. The minimum input rate is 23% of the maximum input rate. In addition, all other safety controls including safety high limit and DHW flow switch are connected to the controller. The controller will shut down the appliance when an unsafe condition exists or, in some cases, corrects the problem based on the sensor/switch signal.

Step modulation is set on (factory setting) so that the power/speed is increased gradually. This provides the best CH operation. However, if the appliance is being used for heating an indirect hot water tank, the step modulation can be set off. The appliance will then start almost immediately at the maximum setting and the system will heat up faster.

The operating and display panel is shown in Figure 25. The display panel has three primary modes of operation. These are:

- Standby Mode – displays appliance's current status. This is the default operating condition.
- Parameter Mode – used to change control settings.
- Information Mode – displays appliance operating temperatures.

The display and operating controls are summarized in Table 5 and operating condition codes are summarized in Table 6.



**Table 5** Operating and Display Panel

Display		Operating Controls	
1. Power On/Off LED	7. DHW Eco mode LED	A. Power On/Off button	E. °F/°C button
2. CH LED	8. DHW Comfort function LED	B. CH/HW Temp button	F. Comfort button
3. DHW LED	9. Service display	C. - button	G. Service button
4. Temperature display	10. Fault LED	D. + button	H. Reset button
5. Fahrenheit LED	11. CH pressure gauge		
6. Celsius LED			

Notes: An illuminated LED indicates "ON" or active status.  
When the red Fault LED (above the Reset button) flashes on, the burner controller has detected a fault. In the Temperature display (4), a fault code appears.

**Table 6** Operating Condition Codes

Operating condition codes (shown in item 9 in Figure 25):		
<input type="checkbox"/> Off (frost protection active)	<input type="checkbox"/> Self-test	<input type="checkbox"/> CH operating
<input type="checkbox"/> Stand-by	<input type="checkbox"/> Blower on	<input type="checkbox"/> Domestic hot water operating
<input type="checkbox"/> 0 Pump overrun	<input type="checkbox"/> Ignition	<input type="checkbox"/> Comfort function is on or internal frost protection
<input type="checkbox"/> 1 Set temperature reached		

The code shown in item 9 in Figure 25 indicates the following operating condition:

## ☐ Off

The appliance is not operating, but the power supply is connected to the appliance. There is no response to any demand for DHW or CH; however, the frost protection is active. If the temperature of the water in the heat exchanger drops below 41°F (5°C), the pump starts running, the heat exchanger is heated, code ☐ 7 appears on the service display.

## ☐ Stand-by

After pressing the ☐ button of the appliance, the operating condition LED is off. The LED above the on/off ☐ button is on and if necessary one of the LED's (item 7 and 8) of the domestic hot water comfort function is on. The appliance is ready for responding to the demand for CH or DHW.

## ☐ 0 Pump overrun

After the operation of the CH, the pump has an overrun. This overrun time is set at the factory according to table 8 and may be changed. Also, the controller will automatically run the pump for 10 seconds, once every 24 hours, to prevent it from getting seized. This activation of the pump takes place at the time of the last heat demand 24 hours later. In order to change this time, set the room thermostat higher for a while at the desired time.

### **1 Set temperature reached**

The burner controller can temporarily block the heat demand and stop the burner. This blocking takes place because the required temperature has been reached. When the temperature has dropped sufficiently, the blocking is cancelled.

### **2 Self-test**

The burner controller may regularly carry out a self-test and check the connected sensors. During this time, the controller displays code **2** and does not carry out any other tasks.

### **3 Blower on**

At appliance start-up, the blower is brought to the starting speed. When this speed is reached, the burner is ignited. Code **3** is also visible during blower post-purge after stopping the burner.


### **4 Ignition**

When the blower has reached the ignition speed, the burner is ignited by means of electric spark ignition. During ignition, code **4** appears. If the burner is not ignited, another ignition attempt is made after about 5 seconds. If the burner has still not fired after the fourth ignition attempt, the controller indicates a fault. See section 6.1.

### **5 CH operation**


A room thermostat can be connected to the controller, if necessary, in combination with an outdoor sensor. See the electric wiring diagram of section 1.6. When heat is demanded by a thermostat signal, the blower runs (code **3**) and the burner is ignited (code **4**), followed by the CH operating condition (code **5**).

During CH operation, the blower speed and hence the input rate of the appliance is adjusted. This is done in such a way that the temperature of the CH water is controlled towards the set CH supply temperature. In the case of on/off thermostat, the CH supply temperature is set at the operating panel and remains fixed. In the case of an outdoor sensor, the CH supply temperature will automatically adjust based on the outdoor air temperature and the outdoor reset function programmed by the user.

The CH supply temperature can be set between 86 °F (30°C) and 194 °F (90°C) and will be displayed on the operating panel. During CH operating mode, the set CH supply temperature is displayed on the operating panel, and the actual CH supply temperature can be read by pressing and holding the service key .

### **6 Domestic hot water operation**

The hot water supply (HW) has priority over CH heating. When the flow switch detects a domestic hot water demand of more than 0.53 USGPM (2 l/min), the CH heating demand is interrupted. After starting the blower (code **3**) and ignition of the burner (code **4**), the controller goes to domestic hot water operation (code **6**).

During domestic hot water operation, the blower speed and hence the input rate of the appliance is controlled based on the set domestic hot water temperature. The domestic hot water temperature can be set between 104 °F (40°C) and 149 °F (65°C). During DHW operating mode, the set domestic hot water temperature is displayed on the operating panel, and the actual domestic hot water supply temperature can be read by pressing and holding the service key .

### **7 Supply domestic hot water without time delay**

For a quick supply of domestic hot water, a comfort function has been provided in the controller. This function keeps the heat exchanger at the correct temperature. This comfort function is set as per section 2.4.1 c. Code **7** is also displayed when appliance frost protection is active (see code **-** Off).

### 2.2 PC INTERFACE

The controller has an interface for a PC. With a special cable and accompanying software, a PC can be connected. This provision makes it possible to follow the behaviour of the controller, the appliance and the heating system during a long period.

### 2.3 TEST PROGRAMS AND FROST PROTECTION

#### 2.3.1 TEST PROGRAMS

In the burner controller, there is a provision for putting the appliance into a test status. This test can be done with heat demand on or off.

By activating a test program, the appliance will become active with a fixed blower speed without intervention of the control functions. The safety functions remain active though.

Simultaneously press  $\oplus$  and  $\ominus$  on the temperature display of the operating and display panel to switch off the test program. The test program will automatically switch off after 10 minutes.

**Table 7** Test Programs

Description of program	Press buttons on display panel simultaneously	Display reading
Set burner on with minimum CH input	$\otimes$ and $\ominus$	"L"
Set burner on with maximum CH input	$\otimes$ and $\oplus$ (1x)	"h"
Set burner on with maximum DHW input	$\otimes$ and $\oplus$ (2x)	"H"
Switch off test program	$\oplus$ and $\ominus$ (or automatically off after 10 minutes)	Current operating condition

#### 2.3.2 FROST PROTECTION

The appliance has provision for protecting its heat exchanger as described below.

**NOTE:** To avoid the condensate freezing, the appliance must be installed in a FROST-FREE room.



- In order to avoid appliance (heat exchanger) freezing, an appliance frost protection has been built in. When the temperature of the heat exchanger drops to 41 °F (5°C), the burner will be activated and the pump starts running until the heat exchanger temperature reaches 50 °F (10°C). Code 7 is given when the appliance frost protection intervenes (heating heat exchanger).
- When the system (or a part thereof) can freeze, a frost thermostat should be installed in the area to be protected. Connect this according to the wiring diagram. See section 1.6.

**REMARK:**

When the appliance is out of action ( - on the service display), the appliance frost protection is still active. However, there will be no response to heat demand from an (external) frost thermostat.


The external frost thermostat is not active when the appliance has been switched off at the control panel or when the main power supply has been interrupted.




### 2.4 SETTING AND ADJUSTMENT

The functioning of the appliance is mainly determined by the parameter settings in the controller. User parameters can be set directly through the operating panel without entering the service code, while the installer parameters only can be changed by entering the service code.

#### 2.4.1 USER PARAMETER SETTINGS





##### 1. Appliance on/off


The appliance is activated by means of the On/Off  button (Figure 25, item A) on the operating and display panel.

When the appliance is switched on, by pressing the On/Off  button, the green Power On/Off LED (Figure 25, item 1) will be on. When switching the appliance off, by pressing the On/Off  button, code  is shown on the service display (Figure 25, item 9) to indicate it is still powered.

##### 2. Change the settings of the various functions





###### a. Change CH supply temperature


Press and hold the CH/HW temp  button on the operating panel until the temperature display flashes. Pressing the CH/HW temp  button again will switch between CH and DHW; the CH LED should be on. The CH supply temperature can be changed using the  and  buttons. The CH supply temperature can be changed between 86 °F (30°C) and 194 °F (90°C).

After completing the change, confirm the change by pressing the Reset  button if no other changes are required. If no button is pressed after a period of 30 seconds, the parameter change menu is closed automatically with any changed settings stored.


**Note:** If an outdoor reset sensor is connected, the displayed CH temperature is not a set temperature.



###### b. Change domestic hot water (DHW) temperature

Press and hold the CH/HW temp  button on the operating panel until the temperature display flashes. Pressing the CH/HW temp  button again will switch between CH and DHW; the DHW LED should be on. The DHW supply temperature can be changed using the  and  buttons. The DHW supply temperature can be changed between 104 °F (40°C) and 149 °F (65°C).

After completing the change, confirm the change by pressing the Reset  button if no other changes are required. If no button is pressed after a period of 30 seconds, the parameter change menu is closed automatically with any changed parameters stored.



###### c. Domestic hot water comfort

The comfort function of domestic hot water can be set by using the Comfort  button as follows:


- **Eco ( LED on):** The comfort function is self-learning. The appliance is deactivated during the night or after a long absence. The appliance adjusts to the user's pattern of domestic hot water use.
- **On ( LED on):** The comfort function of the appliance is continuously activated to keep the heat exchanger warm. The appliance always supplies domestic hot water immediately.
- **Off (Both LED's off):** The heat exchanger is not kept warm, delaying the supply of hot domestic hot water. When there is no demand for hot domestic hot water, the comfort function can be switched off.

### d. Temperature selection (°F/°C)

The temperature selection on the display can be toggled between Fahrenheit and Celsius as follows:

- **Fahrenheit, °F:** Press the °F/°C  button. The Fahrenheit °F LED will turn on and the Celsius °C LED will turn off.
- **Celsius, °C:** Press the °F/°C  button. The Celsius °C LED will turn on and the Fahrenheit °F LED will turn off.

### 3. Reset button
















When a lock out occurs, a figure is flashing on the service display (figure 25, item 9), the appliance can be restarted by pressing the Reset  button for 5 seconds. Check the possible cause of the fault listed in table 12 of section 6 to determine and resolve the problem before resetting the appliance.

**Note:** After 30 seconds of no action, the changes will automatically be stored and the controller will return to normal.

## 2.4.2 INSTALLER PARAMETER SETTINGS




The appliance burner controller has been set to the factory default parameters listed in Table 8 of Section 2.4.3.

These parameters can only be changed with the service code. Proceed as follows to activate the program memory:

1. Switch off the appliance by using the On/Off  button (  on the service display).
2. Simultaneously press the Service  and Reset  buttons, until a  appears on the service and the temperature displays.
3. Using the  and  buttons, set  (service code) on the temperature display.
4. Press the Service  button to confirm the service code.
5. Use the Service  button to select the parameter to be changed (the parameter will be displayed on the service display).
6. Use the  and  buttons to set the selected parameter to the required value (the value will be displayed on the temperature display).
7. Repeat the steps 5 and 6 for other parameters which require change.
8. After making all required changes, press the Reset  button until  appears on the service display.
9. Switch on the appliance again using the On/Off  button.

The controller has now been reprogrammed.

Notes:

- Pressing the On/Off  button, before pressing the Reset  button to confirm the changes, takes you out of the setting menu without storing the parameter changes
- After entering the installer parameter setting, pressing the Service  button for 5 seconds will restore factory parameter settings and 'F.Set' will appear on the temperature display.

## 2.4.3 SETTING AND DESCRIPTION OF PARAMETERS

The factory default settings and setting ranges for all parameters are shown in Table 8. The CH operating input rating can be changed by adjusting the CH input rating % and/or blower speed following the sections 2.4.2 and 2.4.4.

**Table 8** Installer parameters description and default settings for HSE-125

Parameter (service display)	Description	Default setting (temp. display)	Optional Setting of parameter
0	Service code [15]		To access the installer settings by entering the service code 15.
1	System type	0	0 = Standard (CH+DHW operation) 1 = CH operation + Indirect hot water tank 2 = DHW operation only 3 = CH operation only
2	CH pump continuous	0	0 = pump overrun 1 = pump continuously active 2 = n/a 3 = pump on/off with external economy switch
3	CH input rating %	99	Setting range: parameter c to 100%
4	HW input rating %	99	Setting range: parameter d to 100%
5	Min. CH supply temperature of outdoor reset curve	25°C [77°F]	Setting range: 10°C to 25°C [50°F to 77°F] (Outdoor temperature reset control)
6	Min. outdoor temperature of outdoor reset curve	-7°C [20°F]	Setting range: -30°C to 10°C [-22°F to 50°F] (Outdoor temperature reset control)
7	Max. outdoor temperature of outdoor reset curve	25°C [77°F]	Setting range: 15°C to 30°C [59°F to 86°F] (Outdoor temperature reset control)
8	CH pump off delay time after CH operation	1	Setting range: 0 - 15 minutes
9	CH pump off delay time after external hw tank operation	1	Setting range: 0 - 15 minutes (n/a)
A	Three-way or two-way valve position	0	0 = confirmed during CH operation (n/a) 1 = confirmed during hw operation (n/a)
b	Booster	0	n/a
C	Modulating option	1	0 = modulation off during CH operation 1 = modulation on during CH operation
c	Minimum input rate CH	30	Setting range 25 to 50%
d	Minimum input rate HW	30	Setting range 25 to 50%
E	Min. supply temperature during OT demand (OT = OpenTherm stat)	40°C [104°F]	Setting range 10°C to 60°C [50°F to 140°F]. If the OT thermostat demands a supply temperature that is below this set value, the heat demand cannot be met.
E.	OT response	1	0 = Ignore OT demand if < value par E 1 = If OT demand < par E then OT demand = par. E 2 = Enable OT
F	Ignition blower speed	70	Setting range: 50 to 99%
F.	Ignition blower speed only DHW	70	Setting range 50 to 99%
h	Blower speed for determining input rating	47	Setting range: 42 to 52 max. (42 = 4200 rpm, 52 = 5200 rpm).
n	Set point CH (flow temperature) during heating external DHW tank	85°C [185°F]	Setting range: 60°C to 90°C [140°F to 194°F]
o	CH time delay on after DHW satisfied	0	Setting range: 0 – 15 minutes.
P	Minimum off time after CH satisfied or boiler off	5	Setting range: 0 to 10 minutes (anti cycling function)



**Table 8a** Installer parameters description and default settings for HSE-145

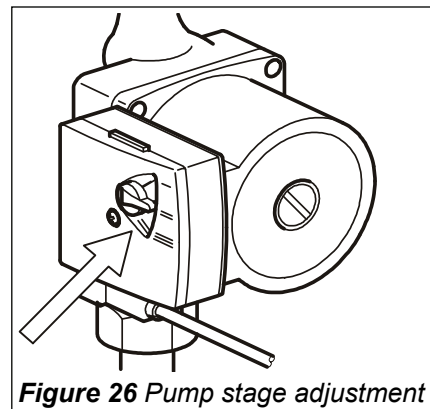
Parameter (service display)	Description	Default setting (temp. display)	Optional Setting of parameter
0	Service code [15]		To access the installer settings by entering the service code 15.
1	System type	0	0 = Standard (CH+DHW operation) 1 = CH operation + Indirect hot water tank 2 = DHW operation only 3 = CH operation only
2	CH pump continuous	0	0 = pump overrun only 1 = pump continuously active 2 = n/a 3 = pump on/off with external economy switch
3	CH input rating %	99	Setting range: parameter c to 100%
4	HW input rating %	85	Setting range: parameter d to 85%
5	Min. CH supply temperature of outdoor reset curve	25°C [77°F]	Setting range: 10°C to 25°C [50°F to 77°F] (Outdoor temperature reset control)
6	Min. outdoor temperature of outdoor reset curve	-7°C [20°F]	Setting range: -30°C to 10°C [-22°F to 50°F] (Outdoor temperature reset control)
7	Max. outdoor temperature of outdoor reset curve	25°C [77°F]	Setting range: 15°C to 30°C [59°F to 86°F] (Outdoor temperature reset control)
8	CH pump off delay time after CH operation	1	Setting range: 0 - 15 minutes
9	CH pump off delay time after external hw tank operation	1	Setting range: 0 - 15 minutes (n/a)
A	Three-way or two-way valve position	0	0 = confirmed during CH operation (n/a) 1 = confirmed during hw operation (n/a)
b	Booster	1	0 = DHW booster function off 1 = DHW booster function on
C	Modulating option	1	0 = modulation off during CH operation 1 = modulation on during CH operation
c	Minimum input rate CH	25	Setting range 20 to 50%
d	Minimum input rate HW	25	Setting range 20 to 50%
E	Min. supply temperature during OT demand (OT = OpenTherm stat)	40°C [104°F]	Setting range 10°C to 60°C [50°F to 140°F]. If the OT thermostat demands a supply temperature that is below this set value, the heat demand cannot be met.
E.	OT response	1	0 = Ignore OT demand if < value par E 1 = If OT demand < par E then OT demand = par. E 2 = Enable OT
F	Ignition blower speed CH	40	Setting range: 35 to 85%
F.	Ignition blower speed DHW only	40	Setting range: 35 to 85%
h	Blower speed for determining input rating	56	Setting range: 52 to 60 max. (52 = 5200 rpm, 60 = 6000 rpm).
n	Set point CH (flow temperature) during heating external DHW tank	85°C [185°F]	Setting range: 60°C to 90°C [140°F to 194°F]
o	CH time delay on after DHW satisfied	0	Setting range: 0 – 15 minutes.
P	Minimum off time after CH satisfied or boiler off	5	Setting range: 0 to 10 minutes (anti cycling function)

## 2.4.4 SETTING CH & DHW OPERATING INPUT RATING

CH and DHW operating input rating are determined based on the CH or DHW input rating % (parameter 3 & 4), blower speed (parameter h) and maximum input rating.

**Table 9** CH and DHW operating input rating

CH and DHW input setting (parameter 3 & 4) <i>*DHW max 85% for HSE-145</i> (%)	HSE-145 Input Rate Btu/h (kW)	HSE-125 Input Rate Btu/h (kW)
100	145,000 (42.5)	124,000 (36.3)
90	130,500 (38.3)	111,600 (32.7)
80	116,000 (34.0)	99,000 (29.0)
70	101,500 (29.8)	87,000 (25.4)
60	87,000 (25.5)	74,400 (21.8)
50	72,500 (21.3)	62,100 (18.2)
40	58,000 (17.0)	50,000 (14.5)
30	43,500 (12.8)	37,200 (10.9)
23	33,000 (9.7)	28,700 (8.4)



**Figure 26** Pump stage adjustment

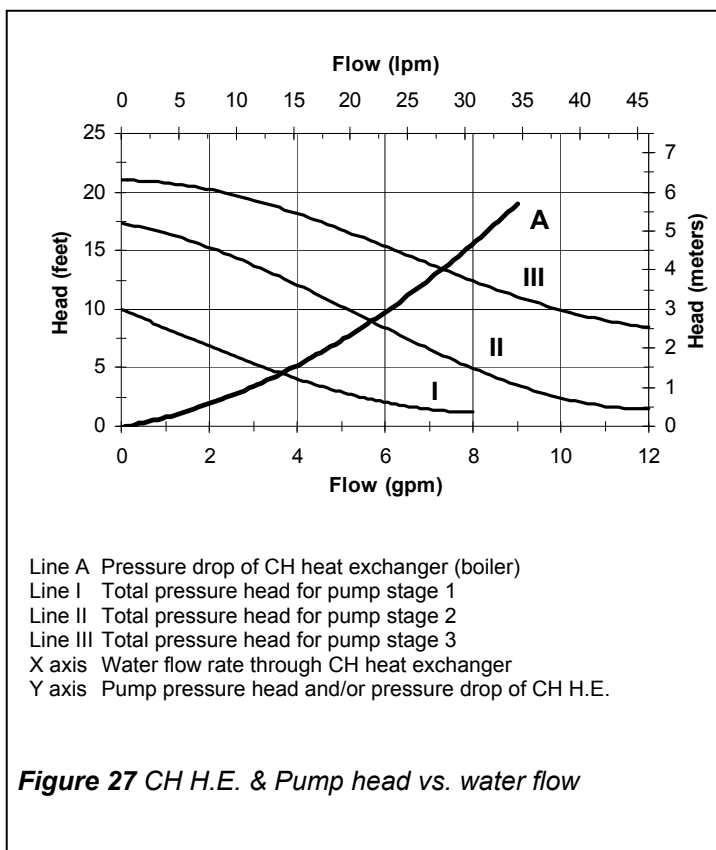
## 2.4.5 PUMP HEAD AND PRESSURE DROP OF CH H.E.

If the appliance is equipped with a variable speed pump, the water flow rate/total pressure head can be adjusted by turning the pump switch, as shown in figure 26.

- Set the pump stage based on the selected CH operating input rating and pressure drop of the boiler heat exchanger. Figure 27 shows the relationship between pressure drop of CH heat exchanger and/or the total pressure head of pump and water flow rate through CH heat exchanger. The type Wilo Star S21 with three stages is equipped.
- Measure the temperature difference between the CH supply and return of the appliance to ensure that it is about 36°F (20°C). The table 10 shows an example of the minimum water flow rate required with 36°F (20°C) temperature rise.

**Table 10** CH operating input rating vs. water flow rate

CH operating input rating	Min. water flow rate
28,700 BTU/H (8.4 kW)	0.9 GPM (200 l/h)
90,000 BTU/H (26.2 kW)	3.3 GPM (750 l/h)



**Figure 27** CH H.E. & Pump head vs. water flow

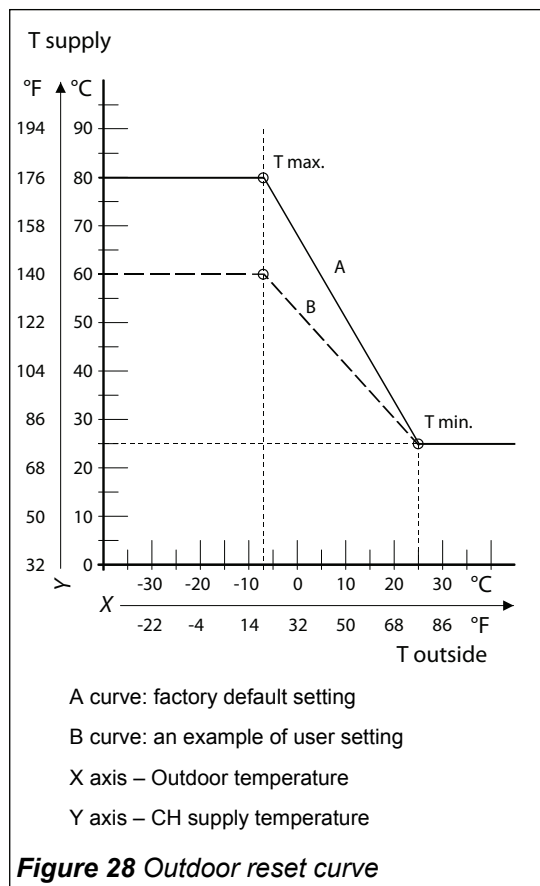
## 2.4.6 OUTDOOR RESET FUNCTION

When the outdoor temperature sensor is connected, the appliance uses the outdoor reset function to control the CH supply water temperature. Outdoor reset automatically and continuously adjusts the CH supply temperature based on the outdoor air temperature following the reset ratio curve. The reset ratio is determined from entering the following parameters in the operating panel:

1. CH supply temperature at minimum outdoor temp  
(see section 2.4.1, #2.a)
2. minimum CH supply water  
(see Table 8, parameter 5)
3. minimum outdoor temperature  
(see Table 8, parameter 6)
4. maximum outdoor temperature  
(see Table 8, parameter 7)

Figure 28 shows examples of the outdoor reset curves.

Note: Outdoor Reset Function cannot operate unless an outdoor temperature sensor is connected. If an outdoor temperature sensor is not connected, the outdoor reset function parameters will be ignored and the boiler will operate at the CH supply temperature setting (as per section 2.4.1, #2.a)



## Startup Instructions

## Section 3



### WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.



### WARNING

Connect the appliance to the mains voltage only after filling and de-aerating!



### WARNING

When an additive is added to the CH water, it must be suitable for use with the materials used in the appliance and system, such as copper, brass, stainless steel, steel, plastic and rubber.

### 3.1 CH SYSTEM OPERATING REQUIREMENTS

The CH system is designed for use in closed loop systems. Operating the CH system in an open system will not result in premature failure of the heat exchanger; however, it will result in premature failure some of the components which are not anti-corrosion type. Also, avoid unnecessary replenishment of CH system water. It can allow oxygen to enter the system and cause serious corrosion problems for parts which are not corrosion resistant. As well, minerals dissolved in a hard water supply will precipitate when heated and preferentially deposit in the heat exchanger. Therefore, do not draw water from the heating system for cleaning, flushing, etc.

The HSE is a condensing appliance with forced air combustion and therefore avoids the typical corrosion and draft problems associated with operating at a low return water temperature. To achieve better appliance efficiency, the system can be designed with a return water temperature of less than 135°F (57°C). A lower the return water temperature will result in higher the efficiency, however, ensure that there is no risk of system water freezing.

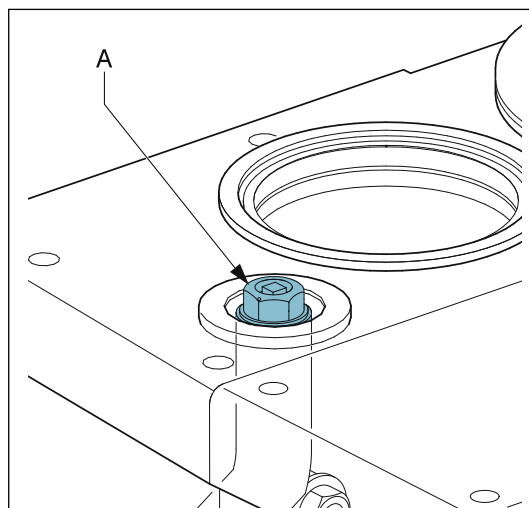
**THE APPLIANCE MUST ALWAYS BE USED FOR HEATING SYSTEMS WITH FORCED WATER CIRCULATION.**

### 3.2 PRE-STARTUP

Prefill the condensate trap with water as shown in Figure 30. **IMPORTANT:** The water must form a liquid-filled trap to prevent exhaust gases from escaping to the appliance room.

#### 3.2.1 CH SYSTEM

1. Fill entire heating system with water to reach appliance operating pressure (see section 1.4.1.4) and purge air from appliance using the manual air vent (A) as shown in Figure 29. Alternatively, an automatic air vent can be mounted on the appliance instead of the manual air vent. Water should be of suitable quality. Do not use water with high hardness.
2. Check all joints and repair any leaks in water piping.
3. Check for proper installation of pressure relief valve and discharge pipe.



**Figure 29 Manual air vent**

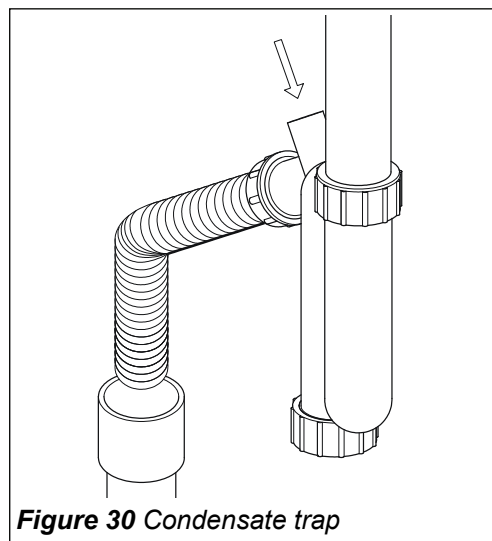
4. Check that the electrical wiring matches the wiring diagram in this manual or on the appliance.
5. Operate circulating pump and vent the system at the highest points of the piping system. Fill the CH system again if the pressure has dropped too low as a result of the de-aerating.

### 3.2.2 DHW SYSTEM

1. The DHW system can be connected to a storage hot water tank. However, do not connect it with an indirect hot water tank or closed system.
2. De-aerate the heat exchanger and the pipe system by opening hot water taps. Leave the tap open until all the air has been released from the system.
2. Check all joints for leaks.

### 3.2.3 GAS SUPPLY

1. This appliance is equipped for operation on Natural Gas. **If propane is used**, convert the appliance using the propane conversion kit and following the conversion instructions in section 3.5.
2. De-aerate the gas pipe at the inlet pressure measuring nipple which is located on the upstream of the gas valve. Do not release gas to the room. Remember that propane does not vent upward naturally.
3. Use a soap solution to check for leaks in gas piping between the meter and appliance gas valve. Repair and retest if necessary.
4. Check that the inlet gas pressure matches with information on the rating plate.



**Figure 30** Condensate trap

## 3.3 STARTUP



### WARNING

The following instructions are intended as a guide for qualified persons. Before lighting the appliance, the pre-startup instructions of *Section 3.2* MUST be performed. If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

### 3.3.1 LIGHTING INSTRUCTIONS



#### WARNING

Should appliance overheat, or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the circulating pump. Instead, shut off the gas supply at a location external to the appliance.

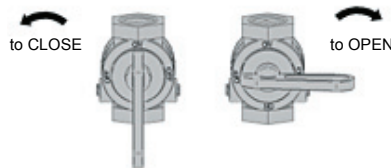
### FOR YOUR SAFETY READ BEFORE OPERATING

**WARNING:** If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.  
**WHAT TO DO IF YOU SMELL GAS**
  - Do not try to light any appliance
  - Do not touch any electrical switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- C. Use only your hand to turn the manual gas valve. Never use tools. If the valve will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.
- If you cannot reach your gas supplier, call the fire department.

### OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Turn off all electrical power to the appliance.
3. Set the room thermostat to lowest setting.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Turn external main manual gas shut off valve off.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
7. Turn external main manual gas shut off valve on.
8. Set room thermostat to desired setting.
9. Turn on all electrical power to the appliance.
10. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.




### TO TURN OFF GAS TO APPLIANCE

1. Turn off the appliance using the ON/OFF switch on the operating panel
2. Turn off all electrical power to the appliance if service is to be performed.
3. Set the room thermostat/other operation control to lowest setting.
4. Close the external main manual gas shut off valve.

### 3.3.2 STARTUP INSTRUCTIONS

In the event of failure of any component, either the system will not operate or it will go into safety lockout. After placing the appliance in operation, the ignition system safety shutoff device must be tested. The method of testing is specified as follows:

- 1) Make sure the gas valve and all electrical power to the appliance is "OFF".
- 2) Set room thermostat to the lowest setting.
- 3) Connect a manometer to the gas inlet pressure tapping located upstream of gas valve to check inlet gas pressure.
- 4) Wait five minutes to clear out any gas. If you smell gas, STOP! Follow the safety instructions provided in *section 3.3.1* under WHAT TO DO IF YOU SMELL GAS. Remember that propane does not vent upward naturally.
- 5) Check the ignition control as follows:
  - a) Switch on the electrical power to the appliance.
  - b) Turn manual shut off gas valve to OFF
  - c) Set room thermostat above room temperature to call for heat and turn power on for the appliance.
  - d) Watch/listen for sparking in the combustion chamber from the inspection hole on the left side of appliance after a few seconds of pre-purge. If no flame is detected after four tries for ignition, the controller will automatically lockout and only restart the ignition sequence after manual reset by pushing the reset  button on the operating panel.
- 6) Turn manual shut off gas valve to ON. The burner should ignite.
- 7) Check for gas leaks at all joints, including upstream and downstream from gas valve.
- 8) Ensure that all other gas appliances are turned off, including their pilot flames.
- 9) Clock the input rate and adjust the inlet gas pressure to match with rating plate, as described in Table 11 of *section 3.6*.
- 10) Adjust gas-air ratio if necessary, as described in *section 3.6.1*.
- 11) Check for proper burner flame characteristics as described in *section 3.4*.
- 12) Heat the water in the heating system to the design temperature.
- 13) Set the required inputs for CH and DHW based on *sections 2.4.2, 2.4.3 and 2.4.4*. Check the temperature difference between the CH supply and return of the appliance. This should be less than 77°F (25°C). If necessary, change the pump position (if equipped with variable speed pump) and/or the manual shut off valve on the return or supply pipe.
- 14) Switch off the electrical supply to the appliance.
- 15) De-aerate the appliance and the system after cooling down, fill up if necessary.
- 16) Check the heating system and the hot water supply for proper operation.
- 17) Return thermostat and controls to normal operation settings.
- 18) Instruct the User about filling, de-aerating and the operation of the heating system and the hot water supply.

### 3.3.3 SEQUENCE OF CONTROL OPERATION

The sequence of control operation is as follows:

- 1) When power is first turned on, 120 Vac is provided to the controller, blower and pump.
- 2) On power-up the controller performs a self check.
- 3) When there is a call for heat, the controller checks whether the supply water temperature is below the set point. If it is, the blower will be energized and speed up to perform the pre-purge. The pump is also activated.
- 4) After the pre-purge, the controller energizes the spark, then gas valve. If the flame is proved, the controller enters the normal operating condition. If the flame is not proved, the controller will retry to light 3 more times. If a flame is still not established, the controller will lockout.

- 5) After flame is established, the controller will modulate the firing rate depending upon the sensed difference between the supply and return water temperatures and the set point of supply temperature. If an outdoor temperature sensor is connected to the appliance, the heating supply water temperature setting will automatically adjust as the outdoor temperature changes.
- 6) Once the call for heat is satisfied, the controller shuts the burner off and, after performing a post-purge, shuts the pump off.
- 7) A demand for domestic hot water is given priority. If a call for DHW is received while the appliance is responding to a call for heat, the heating pump is de-energized until the call for DHW is satisfied.

### 3.4 CHECK BURNER SYSTEM

To maintain safe and efficient operation, examine the burner system regularly through the inspection window (item K on the "Major Components" diagram) on the left side of the appliance behind the cover.

#### **Check condition of burner system**

It is possible for parts of the burner system to become plugged, cracked, eroded and/or dislodged resulting in unsafe operation.

#### **Check for lifting**

Flames should not lift excessively from the burner. The flames may lift slightly during ignition or when the burner is cold.

#### **Check ignition and extinction**

Ignition should flow quickly and smoothly across the burner. Popping noises or explosions from the burner during ignition, extinction or abnormal burner operation indicates the need for service.

#### **Check flame color**

On high fire the flame should be stable and mostly blue. No yellow tipping should be present; however, intermittent flecks of yellow or orange in the flame are normal.

An extremely yellow flame, as seen on a burning candle or match, is an indication of incomplete combustion and is usually accompanied by the formation of soot, and carbon monoxide (carbon monoxide is a lethal, colorless and odorless gas). If soot is allowed to accumulate, it will partially restrict free passage of products of combustion to the flue. Under typical operating conditions, the flame should have a distinct bright blue inner cone and a blue/light orange outer cone.

**If any of the above problems are observed or the burner system does not operate properly, immediately take corrective action.**



### 3.5 CONVERSION TO PROPANE



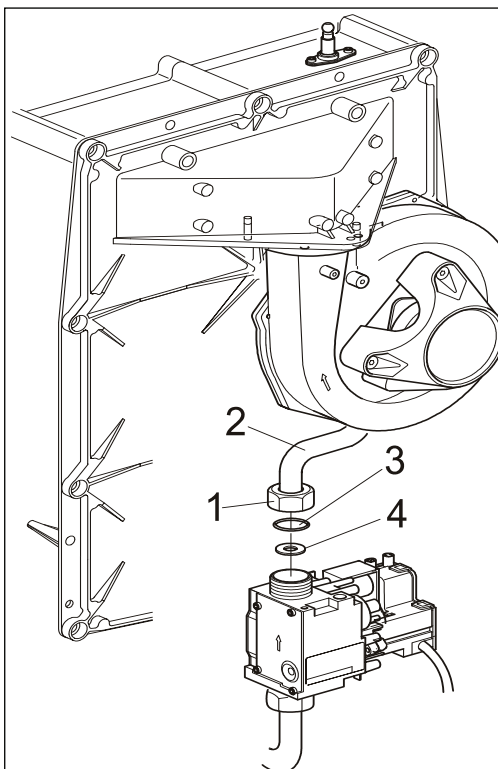
#### WARNING

This conversion should only be carried out by a qualified heating installer or service technician.

When the appliance is connected to a type of gas other than the type specified on the rating plate, the gas orifice ring must be changed and the gas inlet pressure must be adjusted. The gas conversion sets for other types of gas can be ordered from manufacturer. (Refer to Figure 31).

#### Conversion of the gas orifice ring:

1. Switch off the electrical supply to the appliance.
2. Turn the external manual gas shutoff valve off.
3. Remove the front cover of the appliance. Follow section 1.3.4
4. Disconnect the coupling (1) on the gas valve outlet and turn the gas pipe (2) backwards.
5. Replace the O-ring (3) and the gas orifice ring (4) with those provided with the gas conversion set.
6. Reconnect the gas pipe (2) onto the gas valve outlet.
7. Turn the external manual gas shutoff valve on.
8. Switch on the electrical supply to the appliance.
9. Check the gas connections for tightness and leaks after appliance is on.
10. Change parameter h to the value for propane listed in Table 11
11. Check the gas/air ratio and change gas inlet pressure as per section 3.6.1.
12. Perform a test following section 3.2.3.
13. Attach the conversion data label adjacent to the appliance's rating plate. The conversion data label indicates that the appliance has been converted for propane (and high altitude if applicable) use. The correct conversion information must be entered on the conversion data label by the installer.
14. Replace the front cover of the appliance.



**Figure 31** Gas conversion

### 3.6 SETTING OF GAS-AIR RATIO

The gas inlet pressure must not exceed the value specified in Table 11.

The gas-air ratio is set at the factory and normally does not need any adjustment for sea level application.

The gas-air ratio can be checked by measuring the CO<sub>2</sub> percentage in the flue.

In case of replacing the gas valve, converting to another type of gas and/or high altitude application, the gas-air ratio and other parameters listed in table 11 must be checked and adjusted.

The appliance is factory equipped for natural gas. A conversion for propane can be supplied upon request (order number 4001010).

**Table 11** Appliance setting values

Gas type	Natural gas	Propane
CO <sub>2</sub> % at low fire setting (L) (⊖ and ⊖) with front cover off	See notes below	See notes below
CO <sub>2</sub> % at high fire setting (H) (⊕ and ⊕) with front cover off	9.4 ± 0.5	10.3 ± 0.5
Gas inlet pressure, in. w.c. (mm w.c.)	7 (178)	11 (280)
Gas orifice model number	725	580
HSE-125 Maximum blower speed, parameter h	47	49
HSE-145 Maximum blower speed, parameter h	56	56

**NOTES:**

**A. For Natural Gas:**

The CO<sub>2</sub> level at low fire setting must be 0% to 0.3% lower than the CO<sub>2</sub> level at high fire setting. Important: CO<sub>2</sub> level at low fire setting must never be below 8.9%.

**B. For propane:**

The CO<sub>2</sub> level at low fire setting must be 0.3% to 0.6% lower than the CO<sub>2</sub> level at high fire setting. Important: the CO<sub>2</sub> level at low fire setting must never be below 9.5%.


For example (natural gas setting):

- The CO<sub>2</sub> level at high fire setting is 9.5% → the CO<sub>2</sub> level at low fire setting is 9.2% - 9.5%.
- The CO<sub>2</sub> level at high fire setting is 9.0% → the CO<sub>2</sub> level at low fire setting is 8.9% - 9.0%.

For example (propane setting):

- The CO<sub>2</sub> level at high fire setting is 10.5% → the CO<sub>2</sub> level at low fire setting is 9.9% - 10.2%.
- The CO<sub>2</sub> level at high fire setting is 10.0% → the CO<sub>2</sub> level at low fire setting is 9.5% - 9.7%.

### 3.6.1 ADJUST THE GAS-AIR RATIO BY MEASURING THE CO<sub>2</sub> PERCENTAGE OF THE FLUE



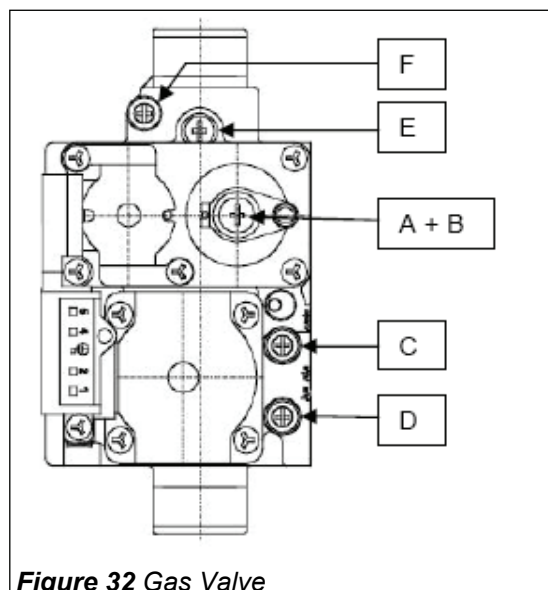
**WARNING**  
Always use a calibrated combustion analyzer to perform the adjustment.

Notes for Figure 32:

- A. Setting screw cover
- B. Screw for low fire adjustment (socket head wrench 4 mm)
- C. Nipple for measuring offset pressure (gas outlet pressure)
- D. Nipple for measuring gas inlet pressure
- E. Throttle screw for high fire adjustment
- F. Nipple for measuring manifold pressure

**Adjust the gas-air ratio as follows:**

1. Switch off the appliance using the On/Off ⊕ button (⊖ on service display).
2. Turn the external manual gas shutoff valve off.
3. Remove the front cover of the appliance.
4. Loosen the screw in the nipple D on the gas valve with two turns and connect a pressure manometer on it to measure gas inlet pressure.
5. Turn the external manual gas shutoff valve on.



**Figure 32** Gas Valve

6. Switch on the appliance using the *On/Off* ① button.
7. Set the appliance to the maximum input rating by simultaneously pressing the Service ⌚ and ⊕ buttons (twice) on the operating display panel of the controller until an **H** appears on the service display of the controller display panel. (See section 2.3.1)
8. Measure the gas inlet pressure to match the value in table 11 and adjust it if necessary.
9. Check the CO<sub>2</sub> level at high fire setting and compare with the value in Table 11. If necessary adjust the setting of throttle screw (E) to correct CO<sub>2</sub> level at high fire.
10. Set appliance to the minimum input rating by simultaneously pressing the Service ⌚ and ⊖ buttons on the operating display panel of the controller until an **L** appears on the service display. (See section 2.3.1)
11. Measure the CO<sub>2</sub> value. If the CO<sub>2</sub> value does not match with the value in table 11 and notes, proceed as follows. Otherwise, skip ahead to step 17.
12. Remove the setting screw cover (A) with a torx T15 screwdriver.
13. Using a torx T15 screwdriver, adjust the setting screw (B) to the correct CO<sub>2</sub> value (clockwise higher and counter clockwise lower).
14. After finishing measurement and setting, replace the setting screw cover (A).
15. Then, set the appliance to the maximum input rating by simultaneously pressing the Service ⌚ and ⊕ buttons (twice) on the operating panel of the controller until an **H** appears on the service display.
16. Measure the CO<sub>2</sub> value again at high fire. Ensure that the CO<sub>2</sub> value is within the range listed in table 11. If the CO<sub>2</sub> value does not match the value in Table 11. Please contact the manufacturer.
17. To exit the test mode, simultaneously press the ⊕ and ⊖ buttons on the operating panel.
18. Switch off the appliance using the *On/Off* ① button ( **-** on service display).
19. Turn off the external manual gas shutoff valve.
20. Remove the combustion analyzer probe and plug the opening.
21. Remove the pressure manometer and tighten the screw in nipple D without leakage.
22. Switch on the appliance using the *On/Off* ① button.
23. Turn the external manual gas shutoff valve on.
24. Replace the front cover of the appliance.

After the appliance has been adjusted, the input rating must be verified following the input rating test as described in *Section 3.8*.

### 3.7 APPLIANCE FOR USE AT HIGH ALTITUDE

The appliance is factory equipped for operation at altitudes ranging from **0 to 2,000 feet (0 to 609 m) above sea level for USA** and **0 to 4,500 feet (0 to 1370 m) above sea level for Canada**. The appliance can be used for any altitude without changing any part however some adjustments may be required.

The conversion of an appliance from sea level to high altitude must be performed by a qualified heating installer, service technician or gas supplier and in accordance with the requirements of Section 1.2 of this manual. A conversion data label provided by manufacturer must be attached adjacent to the rating plate to indicate that the appliance has been converted for high altitude use. The correct conversion information must be entered on the conversion data plate by the installer.

To convert a sea level appliance for high altitude use, the reduced high altitude input rate can be achieved by changing the gas outlet pressure to match the value of CO<sub>2</sub> concentration in Table 11 following the procedure in section 3.6.1.

### **Use at Altitudes above 2000 feet (609 m) in U.S.A.**

In USA, for appliance installations at altitudes above 2000 feet (609 m) above sea level, the input rating of the appliance should be reduced at the rate of 4 percent for each 1,000 feet (305 m) above sea level.

### **Use at Altitudes above 4500 feet (1370 m) in Canada**

In Canada, for appliance installations at altitudes above 4500 feet (1370 m), the certified high altitude input rating of the appliance should be reduced at the rate of 4 percent for each additional 1,000 feet (305 m) over 4500 feet (1370 m) or consult local authorities for the input rate reduction.

After the appliance has been converted for high altitude use, the input rating must be verified following the input rating test as described in *Section 3.8*.

## **3.8 CHECK INPUT RATING**



### **WARNING**

Exceeding the allowable input rating can produce dangerous concentrations of carbon monoxide, and cause the appliance to overheat resulting in severe personal injury, death or substantial property damage. Carbon monoxide is a lethal, colorless and odorless gas.

For safety, the input rating shown on the rating plate or specified input rating for high altitude as described in *Section 3.7* must not be exceeded.

### **Input Rating Test**

Consult the local Gas Company to determine the high heating value of the gas supplied in Btu per cubic feet. Operate appliance for 15 minutes starting with all parts at room temperature and check input by clocking gas meter with all other gas appliances turned off, including their pilot flames. Use the following formula:

$$\text{INPUT (Btu/h)} = \frac{(3600) \times (\text{High Heating Value of Gas in Btu/cu.ft.}) \times (\text{Volume of Cubic Feet Timed})}{\text{Clocked Time in Seconds}}$$

To ensure accuracy, clock enough cubic feet of gas so that there is at least one revolution of the test dial and the clocked time is at least 60 seconds.

## **3.9 CHECK FOR CONTROLS**

After the unit has been operated for a while, set the appliance to the maximum input rating as described in *Section 3.6.1, step 15*, and lower the water supply temperature setting below the actual appliance water temperature. The burner should shut off. Return the settings to their required design set points and make sure the appliance cycles normally. Repeat this type of check on the safety high-limit aquastat, thermostat and other system controls to ensure all work satisfactorily. If any of the safety controls do not function, necessary corrections should be made immediately.

## **3.10 CHECK FOR GAS LEAKS**

To identify gas leaks, smell for gas around appliance area and gas piping connections (See *Section 3.3.1*). To check a specific area, including all pipe joints connected to the gas valve, for leakage, spray a mixture of soap and water onto the suspected area – active bubbling indicates a gas leak. The gas leaks of the joint connected to the gas valve outlet should be checked when the appliance is on. **DO NOT TEST FOR LEAKS WITH AN OPEN FLAME.** Gas leaks must be repaired immediately.

## **3.11 CHECK THE CONDENSATE TRAP**

Check that the condensate drain trap, neutralizer (when used), and condensate tube loop (when used) are properly connected. The water should fill the trap to form a liquid-filled trap and not be plugged with excessive sediment. See section 3.2.

### 3.12 INSTALLER'S CHECKLIST

	Reference Section
<input type="checkbox"/> The information printed on the appliance rating plate matches the application (i.e. altitude, input and fuel type).	3.7, 3.8
<input type="checkbox"/> All applicable electrical codes have been met.	1.2, 1.6
<input type="checkbox"/> Gas piping has been purged and checked for leaks with a soap solution, including all joints between the gas valve outlet and gas supply pipe when the appliance is on.	1.5, 3.2.3
<input type="checkbox"/> System is filled with water and all air has been purged. Only oxygen barrier tubing has been used for the system.	1.4
<input type="checkbox"/> The condensing trap is filled with water. When used, the condensate tube and neutralizer are properly connected and filled.	3.2, 3.11
<input type="checkbox"/> A manometer has been used to check the gas inlet pressure against requirements printed on appliance rating plate.	3.3.2, 3.6.1, 3.7
<input type="checkbox"/> All applicable venting codes have been met. Air tube/openings sized to provide adequate supply air for combustion and ventilation, and will not be blocked off.	1.2, 1.7
<input type="checkbox"/> The gas-air ratio has been checked.	3.6, 3.6.1
<input type="checkbox"/> Operate the appliance for 15 minutes, then clock and calculate Btu/h input rate. The input rate must not exceed that specified on the appliance rating plate or specified for high altitude. Clocked BTU/H Input Rate: _____	3.8
<input type="checkbox"/> Perform check of temperature controls: high limit aquastat and thermostat.	3.9
<input type="checkbox"/> Test any other controls as specified by the manufacturer.	
<input type="checkbox"/> Visually inspect main burner to ensure proper flame operating characteristics and ignition/extinction is ok.	3.4
<input type="checkbox"/> Allow the appliance to cycle a few times to ensure functions are operating correctly.	
<input type="checkbox"/> Close external manual shut-off valve and check burner flame extinguishes.	
<input type="checkbox"/> Clearly identify emergency shut-off devices and make the user or owner aware of their location and method of operation.	
<input type="checkbox"/> Fill in the contact information on the cover of the User's Information Manual and leave both manuals in the envelope adjacent to the appliance.	4.2.10
<input type="checkbox"/> Keep appliance area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Combustible materials, gasoline and other flammable vapors and liquids should not be stored in the area of the appliance.	

#### NOTE: INSTALLER'S RESPONSIBILITY

*"Before leaving installations, installers shall ensure that the appliance, accessory, component, equipment, or piping and tubing they installed comply with the Code requirements, and the person initially activating the appliance shall ensure that the appliance is in safe working order."*

*- CSA B149.1-05 Natural Gas and Propane Installation Code*

#### 4.1 SERVICE & MAINTENANCE INSTRUCTIONS

**WARNING**

Electrical shock hazard – before servicing the appliance, disconnect the appliance and heating system from the power supply by switching off the emergency power OFF button or disconnect the relevant power circuit breaker of the house power grid.

Turn off the gas by closing the external main manual gas shut off valve before servicing.

Verify proper operation after serving.

**WARNING**

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

**WARNING**

If any part of this appliance has been under water, inspect the appliance and replace any part of the control system and any gas control which has been under water.

**WARNING**

Keep appliance area clear and free from combustible materials, gasoline and other flammable vapours and liquids.

This appliance has been designed to provide years of trouble-free performance in normal installations. The owner or user should conduct a general external examination covering all items on the "User Checklist" at the beginning of each heating season and in mid-heating season. In addition, the owner or user should have the appliance inspected and cleaned, if necessary, by qualified service technician or gas supplier's service person at least **once every year** at the beginning of the heating season for continued safe operation.

Note that some operating conditions may require more frequent inspections, for example, check and remove any obstruction to the flow of combustion air or venting of flue gases and any combustible materials, gasoline, and other flammable vapours and liquids around the appliance area. Periodically perform a visual check of burner flame.

The "Service Checklist" must only be used by a qualified service technician or gas supplier's service person.

**Always verify proper operation after servicing.**

#### 4.2 SERVICE PROCEDURE

The appliance and the system should be checked and cleaned if necessary. Verify and correct any problem reported by the owner before proceeding with the maintenance procedures.

##### 4.2.1 CHECK APPLIANCE AREA

1. Make sure that no gasoline or other flammable vapors and the liquids and combustible materials are stored in the vicinity of this appliance area or any other appliance.
2. Make sure that no corrosive atmospheres indicated in section 1.7.1 are in the vicinity of the air intake opening.

### 4.2.2 INSPECT THE CONDENSATION TRAP AND DISCHARGE TUBE

1. Follow the maintenance schedule required by the neutralizer supplier.
2. Shut off the appliance and remove the condensate discharge tube from the outlet of condensation trap. Unscrew the slip ring nut from the condensation trap to disconnect it from the appliance.
3. Remove any sediment in the trap and discharge tube and flush them with water.
4. After cleaning, replace the condensation trap onto the condensate outlet of the appliance and discharge tube onto the outlet of the trap. Tighten both of the slip ring nuts by hand only.
5. Fill the trap with water until the water begins to pour out of the drain.

### 4.2.3 CHECK THE WATER AND GAS PIPING SYSTEMS

1. Check all pipes, fittings and components for leaks and ensure they are properly supported.
2. Verify all system components are correctly installed and operating normally.
3. Verify that the pressure of the CH system matches the expansion tank pressure under cold system condition, usually set at 12 psi (83 kPa).
4. Watch the pressure in the CH system does not rise too high as it heats up. Excessive pressure rise indicates incorrect expansion tank sizing or a damaged expansion tank.
5. Check air vent and air separators in the heating system. Make sure that vents do not leak.

### 4.2.4 CHECK THE PRESSURE RELIEF VALVES

1. Before manually operating the pressure relief valves, make sure that the discharge pipes are directed to a suitable place of disposal to avoid a potential scald hazard.
2. Make sure that the discharge pipes of relief valves are full size without any restriction and installed to permit complete drainage of both the valve and discharge line.
3. Check the pressure relief valve and lift the lever to verify the flow at least annually or as recommended on the warning tag of the valve. System has to be refilled after lifting the lever.
4. If the valve fails to seat properly or continually weeps after closing, replace it. Make sure that the weeps are caused by a faulty valve and not by over-pressurized system due to the expansion tank which is waterlogged, undersized or damaged.


### 4.2.5 CHECK ALL WIRING

1. Remove the front cover.
2. Check the ignition cable, connecting terminals and ground wiring to ensure all in good condition and connected securely and properly.
3. Check ground continuity of wiring using continuity meter and replace ground wire if ground continuity is not satisfactory.

### 4.2.6 SERVICE THE VENTING SYSTEM

1. Inspect flue and air passages for any blockages, cracks and joint leakages. If necessary, use a brush and vacuum to clean and remove any blockages, and seal the joints and cracks.
2. Replace any parts which have severely corroded or cracked.
3. Reassemble parts removed during cleaning, ensuring air tightness of flue gas and air passages by resealing the vent-air intake system.
4. Inspect the terminal to ensure it is clear and unobstructed.
5. Soot can be caused by improper burner adjustment. Check and adjust as necessary following sections 3.6, 3.6.1 and 3.8.
6. Return appliance to operation following lighting instructions in section 3.3.

### 4.2.7 SERVICE THE HEAT EXCHANGER IF NECESSARY

1. Shutdown the appliance as described in the lighting instructions in section 3.3.1.
2. Remove the front cover of the appliance.
3. Wait until the appliance and the burner have cooled down.
4. Remove the wire connector connecting blower and the ignition module to the gas valve.
5. Disconnect the gas pipe connected to the inlet of the gas valve.
6. Unscrew the 10 socket screws from the heat exchanger cover and remove it forward complete with gas valve and blower. While removing the heat exchanger cover do not hold from the gas valve and/or the blower.  
*Be careful not to damage the burner, the gas valve and the blower while removing the front plate. The burner does not need any maintenance.*
7. Check the burner surface to make sure no plugging, cracking eroding and/or dislodging resulting in unsafe operation. Never clean the burner with a brush or compressed air. This causes damage to the metal fibre.
8. Check the spark ignition probe and gently clean any deposits if necessary. As the spark gap cannot be checked directly, use a flat surface across the corner of the heat exchanger to measure the distance to the probe. See the picture in section 6.3. The distance should be in the range of 1-1/16 in to 1-9/64 inch (27 to 29 mm). Replace the probe if necessary.
9. If necessary, clean the fins of the heat exchanger from top to bottom with a brush or compressed air.
10. If necessary, clean the bottom side of the heat exchanger and the condensate discharge at the bottom of the flue discharge behind the heat exchanger.
11. After cleaning, fill the condensation trap with water.
12. Check the silicone gasket of the front cover for damage cracks and/or discolouring and replace if necessary.
13. Reinstall the heat exchanger cover on the heat exchanger by screwing in the socket screws with spring washers. Crosswise tighten the socket screws evenly by hand. Then using an Allen key to tight the screws all around the edge.
14. Make sure that the silicon gasket is well placed around the heat exchanger cover.
15. Check the gas pipe gasket for damage and reconnect the gas pipe to the inlet of the gas valve.
16. Re-plug the wire connectors to the blower and the ignition module to the gas valve.
17. Open the external manual gas shutoff valve and check the gas pipes and gas valve for leaks.
18. Check the CH and hot water supply systems for leaks.
19. Switch on the electrical power to the appliance and then push the **ON/OFF**  button on the operating panel to switch on the appliance.
20. Check the CH and hot water supply systems for normal operation.

### 4.2.8 CHECK THE OPERATION OF THE APPLIANCE

Return appliance to operation following lighting instructions in section 3.3. Verify the heating water pressure in the system is correct.

#### 4.2.8.1 CHECK THE CONTROL SETTINGS

1. Following section 2.4 to check the control settings. Adjust settings if necessary.
2. Check the external limit controls. Adjust/replace if necessary.

#### 4.2.8.2 CHECK THE GAS-AIR RATIO

Check gas-air ratio following sections 3.6 and 3.6.1 and adjust it as necessary.



### **4.2.8.3 CHECK BURNER FLAME**

Check the burner flame through the observation port on the left side top of heat exchanger following section 3.4.

### **4.2.9 COMPLETION OF INSPECTION AND SERVICE**

1. Replace the front cover.
2. Put the appliance into operation at the maximum input, and check the gasket joint of the appliance case, including the gasket joints connecting air intake and flue tubes to appliance case, for leaks.
3. Verify the input rating following section 3.8.
4. Check the CH and hot water supply systems for normal operations.

### **4.2.10 REVIEW THE SERVICE WITH OWNER**

1. Review the user's manual with the owner and make sure that the owner understands the importance to perform the periodic service and maintenance specified in the manuals
2. Remind the owner to call a licensed service technician should the appliance or systems exhibit any unusual behavior.

### 4.3 SERVICE CHECKLIST

	<i>Reference Section</i>
<input type="checkbox"/> Do not store anything against the appliance or allow dirt or debris to accumulate in the area immediately surrounding the appliance. The flow of air supply and exhaust must not be obstructed.	4.2.1
<input type="checkbox"/> Check air openings are not restricted and complies with applicable code(s). Adequate supply air is necessary for combustion and ventilation.	1.2, 1.7
<input type="checkbox"/> Check all gasket joints for leakage, and tighten bolts or replace gaskets if necessary.	
<input type="checkbox"/> When the appliance has operated for several minutes, check for leakage around appliance along vent, and other areas susceptible to leakage. Check for dislodged venting.	4.2.6
<input type="checkbox"/> Inspect the flue ways and terminal cap for the presence of soot, rust scale or blockage. The presence of soot, rust scale or corrosion indicates misadjustment. Clean the Terminal Cap Screen.	
<input type="checkbox"/> Inspect and, if necessary, clean the main burner. Check burners to see that they are not cracked or dislodged.	
<input type="checkbox"/> Visually check the main burner flames. A yellow flame caused by improper adjustment is always accompanied by formation of soot which, if allowed to continue, will partially restrict free passage of products of combustion to the flue.	3.4
<input type="checkbox"/> Check that gas piping is secured. Smell for gas leaks around appliance and gas piping connections. Gas leaks can also be checked for using a soap solution; do not use an open flame to check for leaks. Note: Propane is heavier than air and pools in low areas in the event of a leak.	3.10
<input type="checkbox"/> Inspect for leaks in the water piping and at water piping connections.	4.2.3
<input type="checkbox"/> Circulating pumps used in CH system should be inspected for water leaks.	
<input type="checkbox"/> Check for weeping at pressure relief valve outlet during normal operation.	4.2.4
<input type="checkbox"/> Listen for unusual audible sounds in the appliance. Any audible sounds in the CH and hot water supply system may be indications of scaling or lack of sufficient water flow and the system should be checked without delay. Scaling is due to improper maintenance. It is not the fault of the appliance. Scale damage is not covered by warranty.	
<input type="checkbox"/> Check the pressure gauge and expansion tank pressure is within an acceptable range for the CH system.	
<input type="checkbox"/> Keep appliance area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Combustible materials, gasoline and other flammable vapors and liquids should not be stored in the area of the appliance.	
<input type="checkbox"/> Check should be made on ignition system, operation controls and safety shut-off valves.	
<input type="checkbox"/> Check that the condensation trap is filled with water and not clogged including the discharge pipe. Remove any sediment if necessary.	3.2
<input type="checkbox"/> If applicable, periodically inspect low water cutoff for proper operation.	
<input type="checkbox"/> The emergency shut-off devices are identified and the owner is aware of their location and method of operation.	

### 4.4 CAUTION: WATER REPLENISHMENT

Avoid unnecessary replenishment of water in the CH system. It can allow oxygen to enter the system and cause serious corrosion problems for system components which are not anti-corrosion type. As well, an excessive amount of minerals may be deposited in the heat exchanger. Do not draw water from the CH system for cleaning, flushing, etc.

Any audible sounds in the boiler system may be indications of scaling or lack of sufficient water flow and the system should be checked without delay. Scaling is due to improper maintenance. It is not the fault of the appliance. Scale damage is not covered by warranty.

### 4.5 REFRACTORY HANDLING PROCEDURE



#### **WARNING**

The mineral block used in this product are RCFs (Refractory Ceramic Fibers). RCFs pose a possible cancer hazard by inhalation and can cause respiratory, skin and eye irritation. After mineral block has been fired, it will produce increased levels of nuisance dust and poses increased carcinogenic risk.

Follow the precautionary measures below before attempting service or access.

#### **PRECAUTIONARY MEASURES:**

- Avoid breathing fibers and contact with skin and eyes.
- Use a National Institute for Occupational Safety and Health (NIOSH) approved dust/mist respirator.
- Wear long-sleeved, loose fitting clothing, gloves and eye protection.
- Wash work clothes separately from other clothing. Rinse washer thoroughly.
- Operations such as sawing, blowing, tear out and spraying may generate airborne fiber concentration requiring additional protection.
- Use a vacuum with a HEPA filter for clean up.
- Dispose of all RCF scrap and dust in a closed airtight plastic bag.

#### **FIRST AID MEASURES:**

- Eye contact – Flush eyes with water to remove dust for at least 15 minutes. If irritation persists, seek immediate medical attention.
- Skin contact – Wash affected area gently with soap and warm water after handling.
- Difficulty breathing – Move to an area of clean fresh air. Seek immediate medical attention if difficulties persist.
- Ingestion – Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

### Replacement Parts

### Section 5

**NOTE:** To supply the correct part it is important that you state the appliance model, serial number and type of gas when applicable.


Any part returned for replacement under standard company warranties must be properly tagged with Return Goods Authorization Form (R.G.A.), completely filled in with the appliance serial number, etc., and shipped to the Company freight prepaid.

If determined defective by the Company and within warranty, the part will be returned in kind or equal substitution, freight collect. Credit will not be issued.

Refer to *Replacement Parts List*.

## 6.1 POSSIBLE PROBLEMS AND SOLUTIONS

When the service display or the operating panel is flashing, the burner controller has detected a fault. If multiple faults exist, the temperature display shows an additional code (Refer to table 12).

After the fault has been resolved, the burner controller can be restarted by pressing the reset  button on the operating panel.

**Table 12** Fault Codes

Temperature display	Description	Possible problem/solution
10, 11, 12, 13, 14	S1 CH sensor fault	<ul style="list-style-type: none"> <li>Check the wires for continuity</li> <li>Replace S1</li> <li>Heat exchanger block temperature greater than 266°F (130°C)</li> </ul>
20, 21, 22, 23, 24	S2 CH sensor fault	<ul style="list-style-type: none"> <li>Check the wires for continuity</li> <li>Replace S2</li> </ul>
0	CH Sensor fault after self-check	<ul style="list-style-type: none"> <li>Check the wires for continuity</li> <li>Replace CH sensor S1 and/or S2</li> </ul>
1	Temperature too high	<ul style="list-style-type: none"> <li>Air in system</li> <li>Pump does not run</li> <li>Water flow rate too low in CH system, radiators closed, pump setting too low</li> </ul>
2	Incorrect wiring for S1 and S2	<ul style="list-style-type: none"> <li>Check the cable harness</li> <li>Correct the connections of S1 or S2</li> </ul>
3	Flue gas temperature too high	<ul style="list-style-type: none"> <li>Check setting of gas valve</li> <li>Replace sensor S8</li> </ul>
4	No flame signal after 4 ignition tries	<ul style="list-style-type: none"> <li>Manual gas valve is not open</li> <li>Incorrect spark probe gap</li> <li>Gas inlet pressure too low</li> <li>No power to gas valve or ignition unit</li> </ul>
5	No flame signal after 4 restart tries	<ul style="list-style-type: none"> <li>Condensate discharge blocked</li> <li>Flue or Air intake tube blocked</li> <li>Check setting of gas valve</li> </ul>
6	Flame detection fault	<ul style="list-style-type: none"> <li>Replace ignition cable and spark probe</li> <li>Replace ignition unit</li> <li>Replace burner controller</li> </ul>
7	DHW temperature higher than 105°C	<ul style="list-style-type: none"> <li>Check flow rate</li> <li>Ensure X4: 9-10 not connected unless operating in system type 1</li> <li>Replace sensor S3</li> </ul>
8	Blower speed incorrect	<ul style="list-style-type: none"> <li>Blower jammed by appliance front cover</li> <li>Wire between blower and casing</li> <li>Check the wires for poor contact (tacho signal)</li> <li>Replace blower</li> </ul>
17	S3 DHW sensor open circuit	<ul style="list-style-type: none"> <li>Check the wires for continuity</li> <li>Replace S3</li> </ul>
18	S8 Flue gas sensor open circuit	<ul style="list-style-type: none"> <li>Check the wires for continuity</li> <li>Replace S8</li> </ul>
19	S8 Flue gas sensor short circuit	<ul style="list-style-type: none"> <li>Check the wires for short circuit</li> <li>Replace S8</li> </ul>
28	S7 High limit sensor open	<ul style="list-style-type: none"> <li>Check the wires for continuity</li> <li>Replace S7</li> </ul>
29, 30	Faulty gas valve relay on controller	<ul style="list-style-type: none"> <li>Replace burner controller</li> </ul>

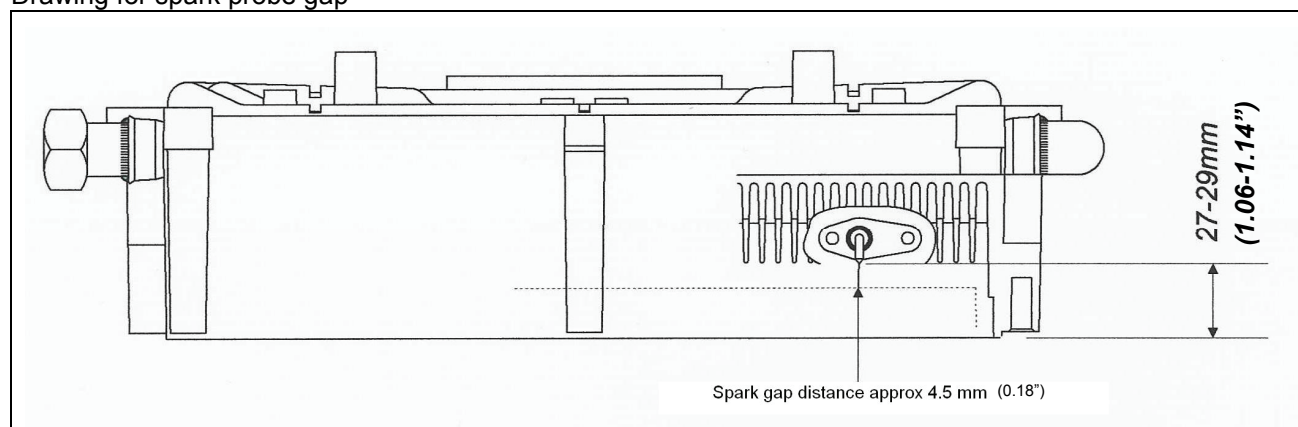
## 6.2 BURNER FAILS TO IGNITE

Possible Problems		Solutions
Manual gas shutoff valve is not open.	⇒ Yes	Open the manual gas shutoff valve.
↓ No		
Air in the gas supply line.	⇒ Yes	Purge the gas supply line.
↓ No		
Gas inlet pressure too low.	⇒ Yes	Contact the gas company.
↓ No		
Venting system/heat exchanger blocked	⇒ Yes	Clean heat exchanger/venting system
↓ No		
No spark. Ignition unit on gas unit faulty	⇒ Yes	1. Check the cabling. 2. Check the spark probe 3. Replace the ignition unit.
↓ No		
Gas-air ratio not adjusted properly	⇒ Yes	Make the adjustment, see section 3.6.
↓ No		
Blower faulty	⇒ Yes	1. Check the wiring. 2. Check the fuse. 3. Replace the blower if necessary.
↓ No		
Blower blockage	⇒ Yes	Clean the blower.
↓ No		
Gas valve faulty	⇒ Yes	Replace the gas valve.

## 6.3 BURNER IGNITES WITH NOISE

Possible problems		Solutions
Gas inlet pressure too high.	⇒ Yes	The gas regulator may be faulty. Contact the gas company.
↓ No		
Incorrect spark probe gap.	⇒ Yes	1. Replace the spark probe. 2. Adjust the spark probe gap.
↓ No		
Gas-air ratio not adjusted properly.	⇒ Yes	Make the adjustment. see section 3.6.
↓ No		
Weak spark.	⇒ Yes	1. Replace the spark probe. 2. Replace the ignition unit on the gas valve. 3. Adjust the spark probe gap.

Drawing for spark probe gap



## 6.4 BURNER RESONATES

Possible problems		Solutions
Gas inlet pressure too low.	⇒ Yes	The gas regulator may be faulty. Contact the gas company.
↓ No		
Re-circulation of the flue gases.	⇒ Yes	Check the venting system.
↓ No		
Gas-air ratio not adjusted properly.	⇒ Yes	Make the adjustment, see section 3.6.

## 6.5 NO HEATING (CH)

Possible problems		Solutions
Room thermostat not closed or outdoor reset sensor faulty.	⇒ Yes	1. Check the wiring. 2. Replace the thermostat. 3. Replace the outdoor reset sensor.
↓ No		
No voltage (24 V) output from the burner controller.	⇒ Yes	1. Check the wiring according to the diagram. 2. Check the connector x4. 3. Replace defective burner controller.
↓ No		
Pump is not operating.	⇒ Yes	1. Check the voltage to the pump. 2. Check the connector x4. 3. Replace defective pump. 4. Replace defective controller.
↓ No		
CH sensor S1 or S2 faulty.	⇒ Yes	Replace sensor S1 or S2. See Fault code display: 1 or 2.
↓ No		
Burner does not ignite.	⇒ Yes	See section 6.2, burner fails to ignite.

## 6.6 REDUCED OUTPUT

Possible problems		Solutions
At maximum input rating setting, the input rating should not decrease by more than 5%.	⇒ Yes	1. Adjust the air-gas ratio 2. Check venting system for blockage 3. Check heat exchanger for soot by measuring emissions.



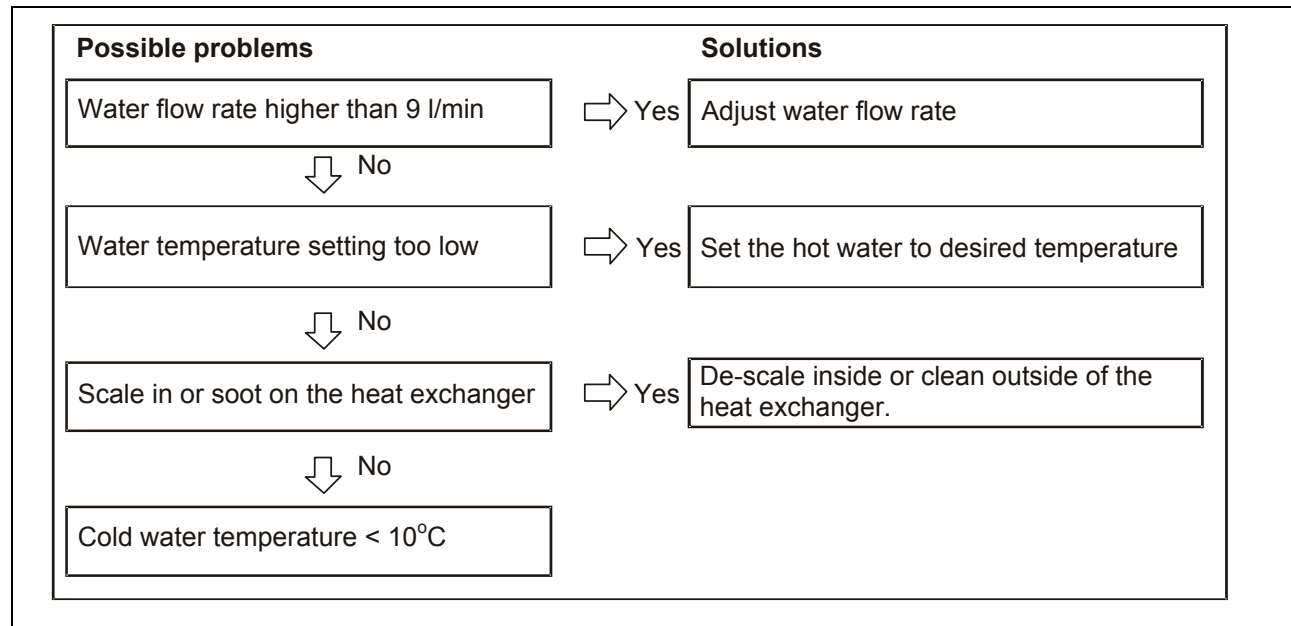
## 6.7 CH SUPPLY WATER DOES NOT REACH CORRECT TEMPERATURE

Possible problems		Solutions
Room thermostat settings not correct.	⇒ Yes	Check the setting and adjust if necessary.
↓ No		
Supply water temperature set too low.	⇒ Yes	1. Correct the temperature setting, see section 2.4.1 item 2 a. 2. Check the outdoor reset sensor for short circuit.
↓ No		
Pump speed not correct or faulty	⇒ Yes	Correct the pump setting or replace the pump.
↓ No		
No water circulation in the system.	⇒ Yes	Check for water circulation: at least one heating loop must be open.
↓ No		
The boiler input rating is not set properly	⇒ Yes	Adjust the input rating setting parameter, see section 2.4.3.
↓ No		
Scale in or soot on the heat exchanger	⇒ Yes	De-scale inside or clean outside of the heat exchanger.

## 6.8 NO DOMESTIC HOT WATER (DHW)

Possible problems		Solutions
Flow switch is faulty or not enough water flow to trigger it	⇒ Yes	1. Water flow < 2.0 l/min 2. Replace the flow switch
↓ No		
No voltage (24 V) output from the burner controller.	⇒ Yes	Check that wiring is according to the wiring diagram
↓ No		
Sensor S3 faulty.	⇒ Yes	Replace sensor S3
↓ No		
Burner does not ignite.	⇒ Yes	See section 6.2, burner fails to ignite.

## 6.9 DOMESTIC HOT WATER DOES NOT REACH CORRECT TEMPERATURE



## 6.10 NTC TEMPERATURE SENSORS DATA

**Table 13** NTC Resistances

NTC 12 kOhm					
T, °C (°F)	R, ohm	T, °C (°F)	R, ohm	T, °C (°F)	R, ohm
-15 (5)	76020	25 (77)	12000	65 (149)	2752
-10 (14)	58880	30 (86)	9805	70 (158)	2337
-5 (23)	45950	35 (95)	8055	75 (167)	1994
0 (32)	36130	40 (104)	6653	80 (176)	1707
5 (41)	28600	45 (113)	5522	85 (185)	1467
10 (50)	22800	50 (122)	4609	90 (194)	1266
15 (59)	18300	55 (131)	3863	95 (203)	1096
20 (68)	14770	60 (140)	3253	100 (212)	952

**Notes**

**Notes**